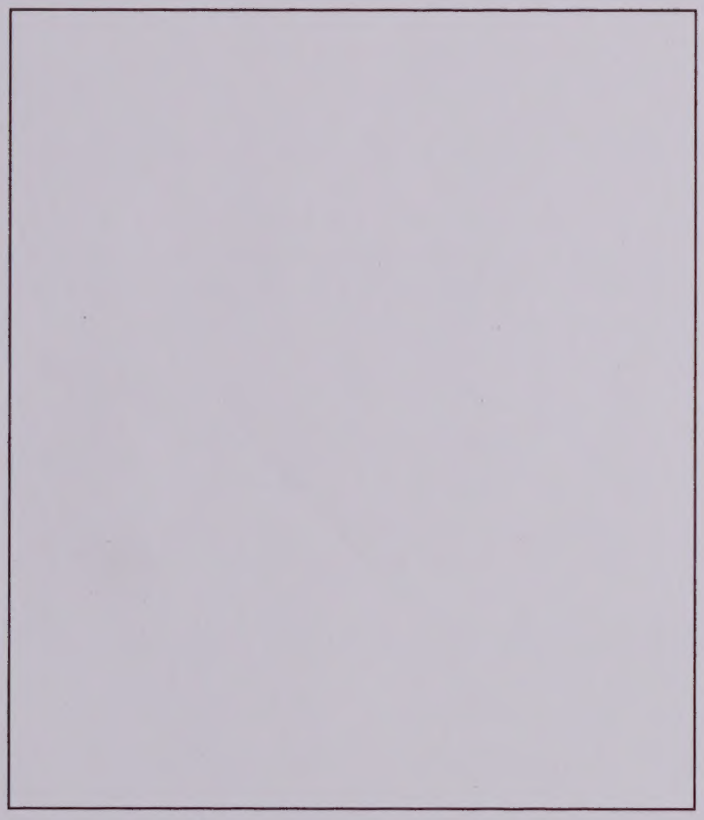
Shrinkwrap protective cover –
Please Discard

DA-30/31 Multi-port Protocol Analyzer



High Speed WAN Data Link Layer Description and Programming Reference

Document to accompany BN 9305/00.17

BN 9308/00.83, BN 9308/00.84, BN 9306/00.82, BN 9308/00.68, BN 9306/00.86,
BN 9308/00.91, BN 9306/00.87, BN 9306/00.83, BN 9305/00.85, BN 9308/00.89, BN 9307/00.66

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DA-30/31 Multi-port Protocol Analyzer

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Notice
Specifications and functions described in this document are subject to change without notice.

This cover sheet provided for 11 separate publications in March 1994 (Release 3.4.2 and after).

Text: Deana Betterton, Roger Edwards, Lynn Remaklus, Carol Ryner and Connie Varner
Layout: Deana Betterton and Carol Ryner

Printed in the USA on recycled paper.

Documentation for Individual Software Packages

Introduction

This package contains documentation for a software package that you have purchased separately from your DA-3x.

- Line Interface Package (LIP)
- Layer Protocol Package (LPP)
- Application or Application Suite

This instruction sheet helps you to find the correct place in your documentation set for inserting the documentation for the software that you have purchased.

Available Documentation

When you purchased your DA-3x, you received the Standard DA-3x Documentation Set, as shown in Figure 1.

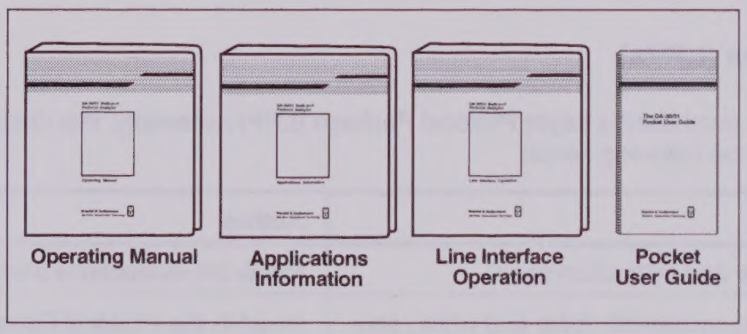

Figure 1 Standard DA-3x Documentation Set

The other available documentation sets, which may be purchased separately, are shown in Figure 2.

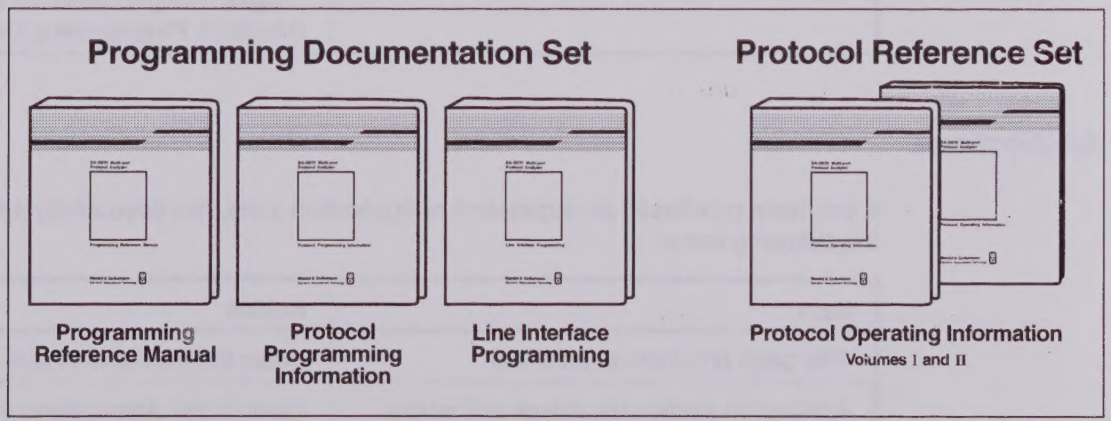

Figure 2 Additional Documentation Available for the DA-3x (sold separately)

Line Interface Packages (LIPs)

If you have purchased a Line Interface Package (LIP) accessory, this document package consists of the following items:

Item	Action
Title page and instruction sheet	follow the instructions and then discard
Operating section tab (blue and white) and operating information document	insert in the *Line Interface Operation* binder (part of the Standard DA-30/31 Documentation Set)
Programming section tab (gray and white) and programming document	if this package includes a programming section, insert the tab in the *Line Interface Programming* binder (part of the DA-30/31 Programming Documentation Set)
Application section tab (black and white) and one or more application documents	insert in the *Applications Information* binder (part of the Standard DA-30/31 Documentation Set)

Layer Protocol Packages (LPPs)

If you have purchased a Layer Protocol Package (LPP) accessory, this document package consists of the following items:

Item	Action
Title page and instruction sheet	follow the instructions and then discard
Operating section tab (blue and white) and operating information document	insert in the *Protocol Operation Information* binder (part of the DA-30/31 Protocol Reference Set)
Programming section tab (gray and white) and programming document	if this package includes a programming section, insert the tab in the *Protocol Programming Information* binder (part of the DA-30/31 Programming Documentation Set)

Applications

If you have purchased an application or application suite, this document package consists of the following items:

Item	Action
Title page and instruction sheet	follow the instructions and then discard
Application section tab (black and white) and one or more application documents	insert in the *Applications Information* binder (part of the Standard DA-30/31 Documentation Set).

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Fourth Edition March 1994 Release 3.4.2 and after

HDLC/LAPB/LAPD

High-Level Data Link Control Protocol Operation

HDLC.1. Introduction

This section describes the protocol-specific operation of the DA-3x with Version 1.6 of the High-level Data Link Control (HDLC) Layer Protocol Package (LPP). This includes Versions 1.1 of LAPB (Link Access Procedure B Channel) and LAPD (Link Access Procedure D Channel) which are subsets of HDLC and operate within X.25 packet-switched networks. We will refer to this group of three protocols as the DLC protocols. Release Notes will address any changes affecting this operating information.

The preface to this binder provides directions for installing the DLC protocols on your hard disk and instructions for loading a protocol in the protocol stack.

HDLC.1.1. Introduction to the DLC Protocols

The DLC protocols operate at the OSI Data Link Layer (Layer 2). HDLC is the ISO standard for Data Link Layer operations in wide area networks. These protocols take responsibility for managing synchronous, code-transparent, serial-by-bit information transfer between nodes that data links join. The DLC protocols manage line discipline, interpret commands, generate responses, control data flow, and manage error control and recovery functions.

In wide area network topologies, data links are either point-to-point (two stations on a link) or multi-point (more than two stations per link). Line discipline is simple in point-to-point environments; the two nodes establish which is to transmit, which is to receive, and that the receiver is ready to receive. Next, if the transfer is acknowledged, the transmitter sends data in one or more acknowledged blocks. When the transmission is complete, the transmitter and receiver terminate the relationship.

In multi-point environments, access to the data link requires management. One of three response modes establishes whether the stations using the link share a peer-to-peer relationship or are in a master-slave configuration. Table HDLC-1 provides descriptions of the three response modes.

Response Mode	Description
Normal Response Mode	Stations are master and slave. The primary station controls the access of the secondary stations to the transmission carrier by a scheme known as polling. The primary station polls each secondary node before they can transmit. Multi-point configurations usually use this mode.
Asynchronous Balanced Mode	Stations are peer-equals and either may initiate transmission without receiving permission from the other. Point-to-point configurations usually use this mode.
Asynchronous Response Mode	The primary station has responsibility for line initialization, error recovery and disconnection, but secondary stations can transmit without explicit permission from the primary. Configurations rarely use this mode.

Table HDLC-1 Network Station Response Modes

In each of these response modes the network stations identify themselves by an address. Depending on the particular installation, the address may be one or two bytes in length. This layer manages other aspects of line discipline by determining whether the link is half- or full-duplex, that is, whether data transmission can occur only in one direction at a time (half-duplex) or in both directions simultaneously (full-duplex).

Table HDLC-2 provides the three formats of DLC protocol frames.

Protocol Frame Formats	Description
Supervisory	Supervisory frames indicate the state of the transmitter-receiver. These frames include Receive Ready, Reject, Receive Not Ready and Selective Reject.
Information	Information frames transmit data.
Unnumbered	Unnumbered frames are control frames that provide initialization, polling, and status reporting. Some of these frames contain a variable size Information field for the control information.

Table HDLC-2 Protocol Frame Formats

Each frame begins with a one-byte flag, which alerts the receiver to the frame's presence. The address field (one or more bytes) is the next frame component, followed by a control field with optional Information field (one or more bytes). After the higher-layer-protocol data, a two-byte Frame Check Sequence (using a cyclic redundancy checksum) allows the receiving station to verify the accuracy of bit transmission. The frame ends with another one-byte flag.

The DLC protocols provide end-to-end verification and error recovery by sequencing and acknowledgment procedures. Each DLC protocol user maintains a Send Counter and Receive Counter, called Ns and Nr, for frames carrying information. Information frames transmit values for both Ns and Nr; Supervisory frames transmit a value for Nr; Unnumbered frames do not have an Ns or Nr field.

The DLC protocol user checks the Nr and Ns values in the relevant frames against its internal counter values. If the DLC protocol user maintains proper sequencing of the Ns and Nr values and does not miss any, the various Information and Supervisory format frames update the internal counters and provide acknowledgments. If the Nr and/or Ns values in the frame are not in sequence, the receiving DLC protocol user returns a negative acknowledgment and request for retransmission by means of one of the Supervisory frames.

A REJ (Reject) frame identifies the first frame in the sequence not received correctly and requires the sending node to retransmit that frame and all frames sent after it. A SREJ (Selective Reject) identifies a single frame for retransmission. This takes advantage of the DLC entity's ability to buffer out-of-sequence frames for future use and reduces the number of frames needing retransmission on the network. The RNR (Receive Not Ready) frame acknowledges the last frame received, but tells the sending station to stop sending. This is usually an indication of a temporary problem.

Regular exchanges of these acknowledgments are important to network flow control, as they prevent large numbers of frame retransmissions from blocking the data link bandwidth. The protocol enforces a frequent acknowledgment pattern by limiting the number of frames that the sender can send prior to an acknowledgment from the receiver. A window that serves as a buffer establishes the limit. The pointer within the window advances as it receives each frame.

The size of the window varies with the *modulo* of the DLC protocol version in use. Modulo 8 operation allows a maximum window size of 8 frames (0-7). The sending station may transmit up to 8 frames before it expects a confirmation from the receiving station. Modulo 128 allows a window of 128 frames (0-127). When the transmitting user sends the maximum number of unacknowledged frames allowed by the window size, it sends no further frames until the receiver sends an acknowledgment.

HDLC Protocol

The HDLC protocol provides for link options to satisfy a wide variety of user requirements. These include half-duplex and full duplex transmission, point-to-point and multipoint configurations, as well as switched and non-switched channels. HDLC supports Modulo 8 and Modulo 128 frame sequencing.

LAPB Protocol

LAPB is a single point-to-point line protocol specification that manages the data interchange between a DCE and a DTE. With the subscription time procedure called MultiLink Procedure (MLP), LAPB has the capability to operate over parallel Single Link Procedure (SLP) physical circuits (multipoint). LAPB supports Modulo 8 and Modulo 128 frame sequencing.

LAPD Protocol

LAPD can function as a point-to-point or multipoint line protocol with data interchange between a single peer entity and broadcaster for an entire group of entities. LAPD also allows for the option of transmission of messages with or without error protection and recovery. LAPD uses the principles and terminology of the DLC protocol procedure, and ITU-TS Recommendations Q.920 and Q.921 outline its use. LAPD operates on networks in Modulo 128 only.

Table HDLC-3 shows the classes of operation, types of frames, and modes of operation for HDLC, LAPB, and LAPD.

Frame Categories	Parameters	HDLC	LAPB	LAPD
Classes of Operation	Unbalanced Normal (UN)	X		
	Unbalanced Asynchronous (UA)	X		
	Balanced Asynchronous (BA)	X	X	X
Types of Frames	Supervisory	X	X	X
	Information	X	X	X
	Unnumbered	X	X	X
Modes of Operation	Modulo 8	X	X	
	Modulo 128	X	X	X

Table HDLC-3 DLC Protocol Parameters

Further information on the High-level Data Link Control protocols is available in the following references:

Stallings, W. *Handbook of Computer-Communications Standards, Volume I: The Open Systems Interconnection (OSI) Model and OSI-Related Standards* New York: Macmillan, 1987

ISO Standard High-Level Data Link Control Procedures 1979

HDLC.1.2. Completing the Configuration Menu

When you load HDLC, LAPB, or LAPD on the protocol stack, a separate configuration menu for each one is available through softkey F4 that allows you to match the DA-3x to the particular implementation of the DLC protocol you have on your network. Figure HDLC-1 shows a sample Configuration Menu for the DLC protocols. Table HDLC-4 provides the configuration default values. The sections that follow describe the configuration menu parameters.

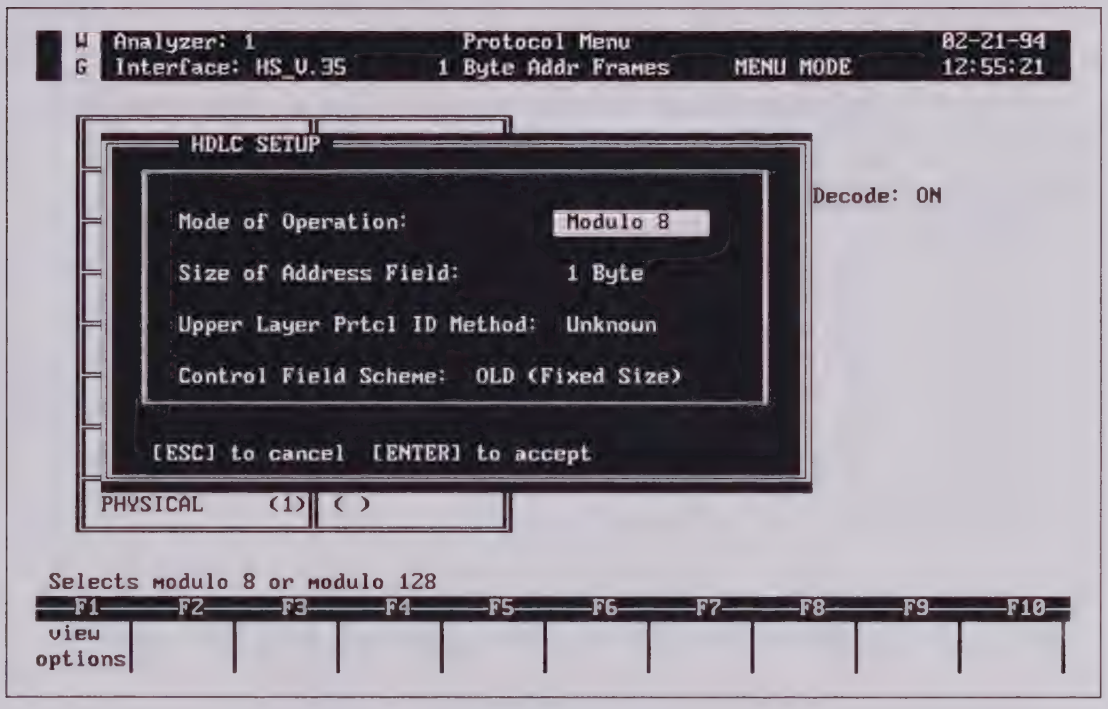


Figure HDLC-1 A sample DLC Protocol Configuration Menu

Configuration Parameters	HDLC	LAPB	LAPD
Mode of Operation	Modulo 8/128	Modulo 8/128	Modulo 128 only
Size of Address Field	1 or 2 bytes	1 byte only	2 or 4 bytes
Multi-Link or Single Link Selection	N/A	Single/Multi	N/A
Upper Layer Prtcl ID Method	Unknown Ethertype ISO TR 9577	Unknown Ethertype ISO TR 9577	Unknown ISO TR 9577
Control Field Scheme	Old (Fixed Size) New (Type Dependent)	N/A	N/A

Table HDLC-4 The DLC Protocol Configuration Default Values

High-Level Data Link Contol Protocol Operation DA-30/31 Protocol Operating Information

HDLC.1.2.1. Mode of Operation

The DLC protocols operate on networks either in Modulo 8 or Modulo 128; the difference is the size of the acknowledgment window. HDLC and LAPB use Modulo 8 or Modulo 128 while LAPD uses Modulo 128 only. In Modulo 8 networks, the sending entity may send only 8 frames (0-7) before the receiving entity must acknowledge at least some portion of them. In Modulo 128, the transmitter may send up to 128 frames (0-127) before the receiving entity must send an acknowledgment. The modulo in use affects the size of the control field in the frame. The DA-3x cannot decode the frames properly unless it knows which modulo is in use.

To select the mode of operation, move the cursor to the Mode of Operation field and press F1 to view the options. Select the mode appropriate to the protocol you are using and press Enter to accept or press Escape to cancel the change and return to the Configuration Menu screen.

HDLC.1.2.2. Size of Address Field

The DLC protocols support either one- or two-byte address fields. HDLC and LAPB use the standard one-byte field (usually addresses 01 or 03) as shown in Figure HDLC-2 and HDLC-3. LAPD uses extended addressing, which is a two-byte format as shown in Figures HDLC-4 and HDLC-5. The DA-3x cannot decode the frames properly unless it knows whether the address field is one or two bytes in length. Move the cursor to the Size of Address field and press F1 to view the options. Select the size appropriate to the protocol you are using and press Enter to accept or press Escape to cancel the change and return to the Configuration Menu screen.

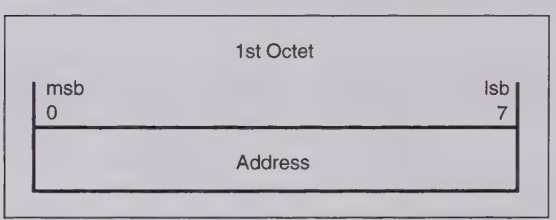


Figure HDLC-2 HDLC/LAPB Single Byte Address

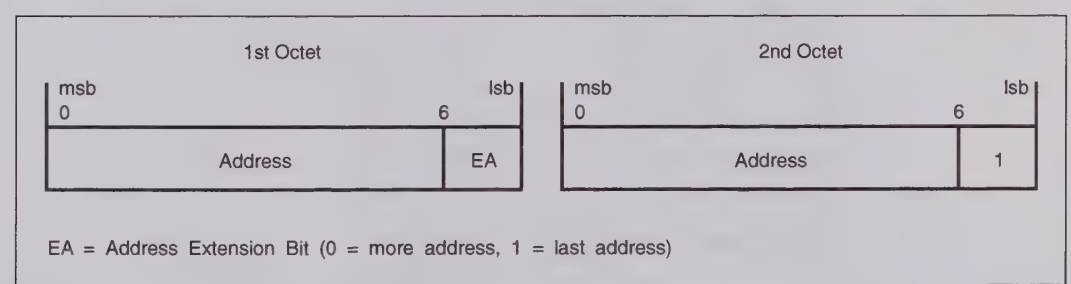


Figure HDLC-3 HDLC Two Byte Address

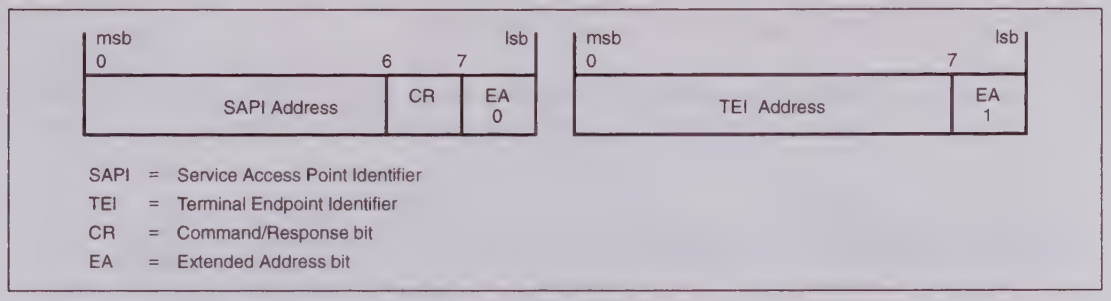


Figure HDLC-4 LAPD Two Byte Address

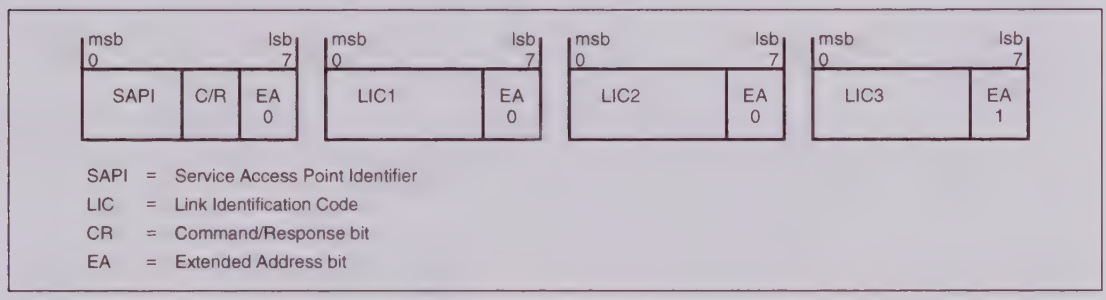


Figure HDLC-5 LAPD Four Byte Address

Table HDLC-5 provides the Command/Response bit values for the LAPD extended (four byte) format.

C/R Bit Value	Description
0	User to Network Command
1	User to Network Response
1	Network to User Command
0	Network to User Response

Table HDLC-5 LAPD Command/Response Bit Values

HDLC.1.2.3. Multi-Link/Single Link Selection

This field is for LAPB use only. To differentiate between the single link operation and the LAPB optional multilink operation, different address pair encodings are assigned to data links operating with multilink procedure compared to data links operating with single link procedure. In the single link procedure, the DCE address is hex 01 and the DTE address is 03. For the multilink procedure, DCE address is 07 and DTE address is 0F. Like the single link procedure, the multilink procedure will discard all frames received with an address other than the addresses associated with single or multilink procedure.

HDLC.1.2.4. Upper Layer Protocol ID Method

The DLC protocols support 2-byte encapsulation of Ethernet and IEEE 802.3 frames. The Upper Layer Protocol Identification Method field allows you to select how to identify the next upper layer protocol. The choices are:

Unknown The protocol identification method is unknown. DLC operates normally without the LAN encapsulation.

Ethertype Ethernet/IEEE 802.3 frames have LAN encapsulation as shown in Figure HDLC-6. The first two bytes of the data field correspond to the type/Length (Ethertype) field of these frames. The remainder of the Ethernet frame maps into the remainder of the data field.

ISO TR 9577 The first byte of the data is used to identify the next protocol as outlined in ISO/IEC TR 9577.

If you are using the IEEE 802.3 protocol, this field is the length field specifying the number of Logical Link Control (LLC) bytes that the data field contains. Length values range from 0000 to 05FF (hex). This field defaults to Unknown.

For more information about Ethernet/IEEE 802.3 or Type values and the protocols they represent, refer to the Ethernet section of the *Line Interface Operation* binder.

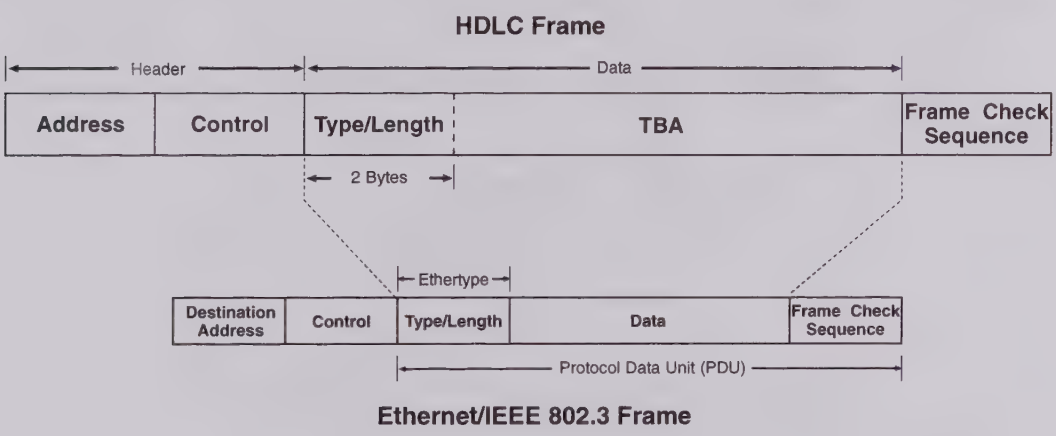


Figure HDLC-6 Ethernet Encapsulation within DLC Protocols

HDLC.1.2.5. Control Field Scheme

The Control Field Scheme is for HDLC Modulo 128 operation only. It controls whether the frame control field is decoded according to the first (old) or fourth (new) edition of the HDLC specification (ISO/IEC 4335). The choices are:

Old Edition - Fixed size The control field is always two bytes.

New Edition - Type dependent The control field is two bytes for Supervisory and Information frames, but only one byte for Unnumbered frames.

HDLC.2. Summary Trace

Figure HDLC-7 shows the DA-3x's trace for HDLC frames. An explanation of each of the Summary Trace fields follows. The trace fields are the same for all three protocols except where noted.

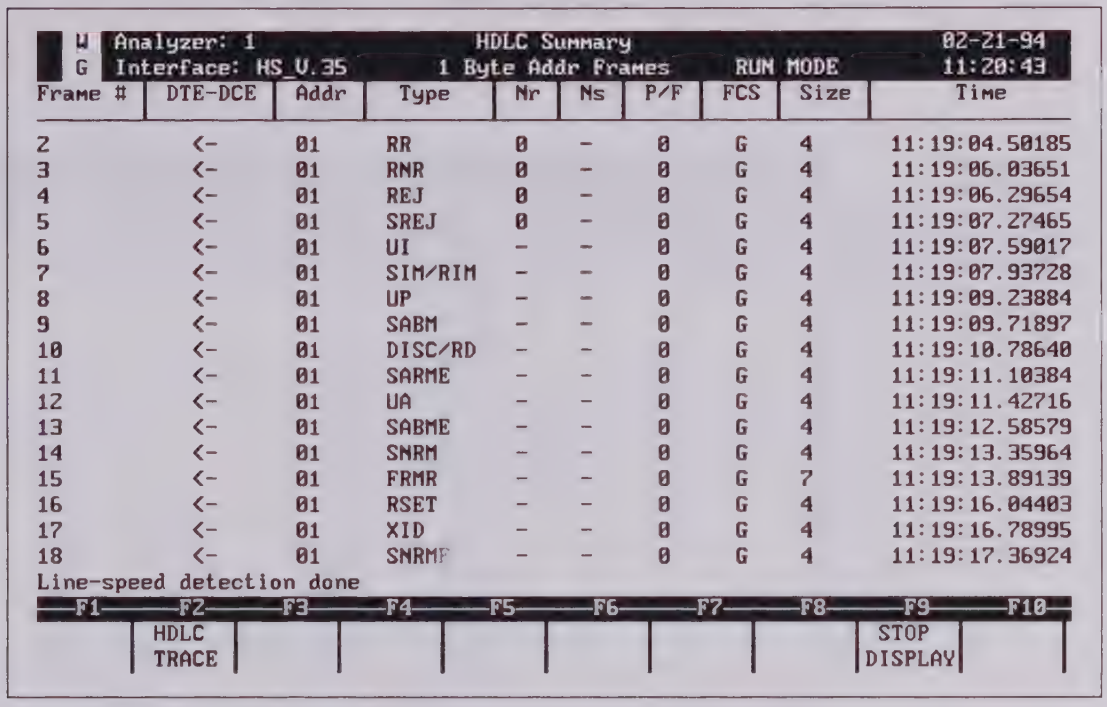


Figure HDLC-7 HDLC Summary Trace

Frame # This field provides the frame number. This is relative to the moment the DA-3x began to monitor frames.

DTE-DCE This field indicates the direction of the frame, relative to the DTE (Data Terminal Equipment) and DCE (Data Communication Equipment).

Addr This field represents the address of the station to which the frame is destined, or which is sending the frame.

Type This field provides the frame type. A glossary at the end of this section defines and gives more details about these applicable frame types.

The bit patterns of the RIM and SIM frames are identical, as are the bit patterns of RD and DISC frames, and SARM and DM frames. When the DLC user (host or secondary) receives the bit pattern, it determines the frame type. Only the host can send SIM, DISC and SARM frames and only a secondary station can send RIM, RD, and DM frames. Since the DA-3x has no way of knowing if the frame is going from host to secondary or from secondary to host, it reports frames with this bit-pattern as "SIM/RIM", "DISC/RD" and "SARM/DM" in the DLC Protocol Trace.

Nr This is the transmitting receive sequence number. This field is the value of the Nr field in Information or Supervisory frames. A dash displays for Unnumbered format frames.

Ns This is the transmitting send sequence number. This field is the value of the Ns field in Information frames. A dash displays for Supervisory or Unnumbered format frames.

P/F This is the poll/final bit. The primary station sends a poll bit to the secondary requiring it to initiate transmission. The secondary station sends a final bit in the last frame of a transmission to the primary.

FCS This field provides the value of the Frame Check Sequence.

Size This field reflects the size in bytes of the DLC frame.

Time This is the timestamp of the frame.

Figure HDLC-8 illustrates a DA-3x summary trace for LAPD frames.

W Analyzer: 1 LAPD Summary 02-22-94
G Interface: HS_V.35 4 Byte Addr Frames RUN MODE 10:37:16

Frame #	DTE-DCE	SAPI	C/R	TEI	Type	Nr	Ns	P/F	FCS	Size	Time
19	<-	0	0	00 00 01	TEST	-	-	0	G	7	10:32:23.7317
20	<-	0	0	00 00 01	INFO	36	0	1	G	22	10:32:33.8090
21	<-	0	0	00 00 01	UI	-	-	0	G	7	10:32:38.3241
22	<-	0	0	00 00 01	DISC	-	-	0	G	7	10:32:39.1475
23	<-	0	0	00 00 01	UA	-	-	0	G	7	10:32:42.8060
24	<-	BAD-LAPD: Frame too short								7	10:32:44.1909
25	<-	0	0	00 00 01	SABME	-	-	0	G	7	10:32:48.5735
26	<-	BAD-LAPD: Unknown frame type								7	10:32:48.8810
27	<-	0	0	00 00 01	RSET	-	-	0	G	7	10:32:58.6087
28	<-	0	0	00 00 01	XID	-	-	0	G	7	10:32:59.7297
29	<-	0	0	00 00 01	TEST	-	-	0	G	7	10:33:01.0490
30	<-	0	0	00 00 01	SABME	-	-	0	G	7	10:33:35.4181
31	<-	0	0	00 00 01	INFO	36	0	1	G	22	10:33:49.1838
32	<-	0	0	00 00 01	UI	-	-	0	G	7	10:33:50.4610
33	<-	0	0	00 00 01	DISC	-	-	0	G	7	10:33:56.3436
34	<-	0	0	00 00 01	UA	-	-	0	G	7	10:33:57.9090
35	<-	0	0	00 00 01	TEST	-	-	0	G	7	10:34:05.9482

Select a Protocol Trace, or [Okay] for the Previous Rack:

F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
lapd TRACE | STOP DISPLAY

Figure HDLC-8 LAPD Summary Trace

The fields for the LAPD Summary Trace are identical to those for HDLC and LAPB except for the following fields which replace the address field.

SAPI SAPI is the Service Access Point Identifier. This is the upper 6 bits of the first byte of the address field displayed as a decimal value.

C/R The code response identifies the frame as a command or response.

TEI TEI is the Terminal Endpoint Identifier. This is 1 or 3 bytes starting with the second byte of the address field displayed as hex.

Note:

When in Run Mode, if you enable Ethernet encapsulation and an Ethernet PDU length error appears during the decoding of Ethertype, no error message displays. However, the bad PDU does not pass to the upper layers.

HDLC.3. DLC Frame Detail

Access the Frame Detail screen in Examine Mode by pressing F9 from the protocol trace softkey rack. If the DA-3x is currently displaying one of the Summary Trace screens, you may need to press Okay (F11) to return to the protocol trace softkey rack. Frame Detail provides a detailed analysis of the packet highlighted on the Summary Trace screen.

The DLC Frame Detail shows the frame description of the headers as well as the associated decimal, hexadecimal, and binary decodes. Decimal values appear under the HEX column with a lowercase d following the value.

Figures HDLC-9 through HDLC-12 provide sample Frame Detail screens.

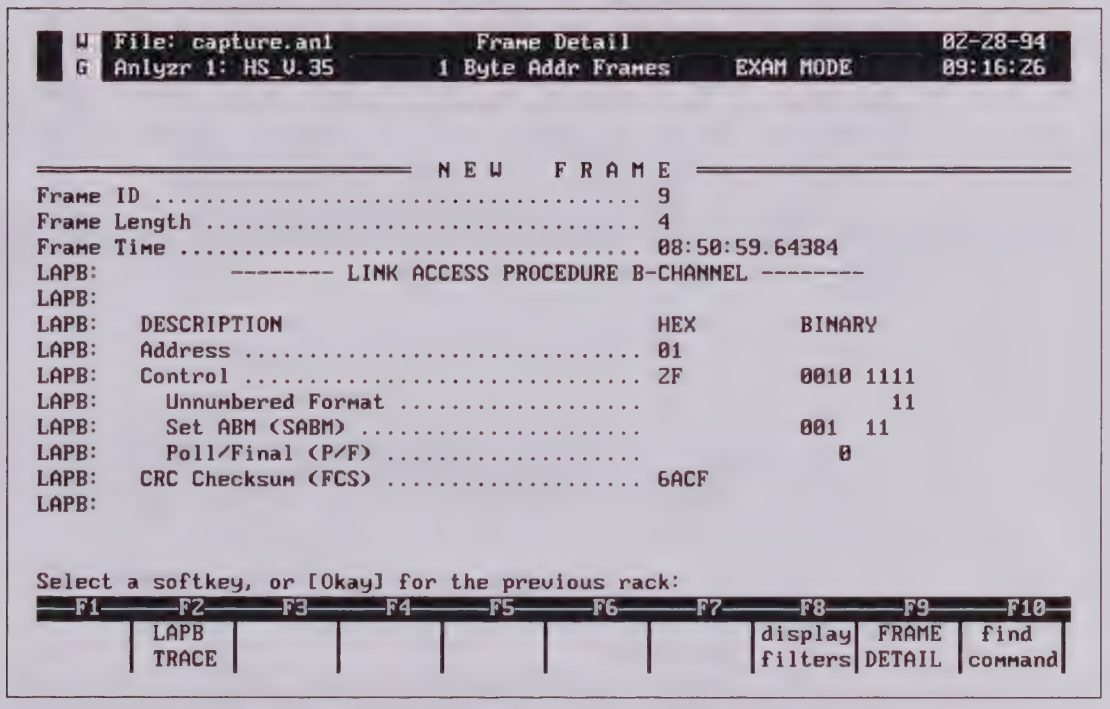

W File: capture.anl Frame Detail 02-28-94
G Anlyzr 1: HS_V.35 1 Byte Addr Frames EXAM MODE 09:16:26
NEW FRAME
Frame ID 9
Frame Length 4
Frame Time 08:50:59.64384
LAPB: -------- LINK ACCESS PROCEDURE B-CHANNEL --------
LAPB:
LAPB: DESCRIPTION HEX BINARY
LAPB: Address 01
LAPB: Control 2F 0010 1111
LAPB: Unnumbered Format 11
LAPB: Set ABM (SABM) 001 11
LAPB: Poll/Final (P/F) 0
LAPB: CRC Checksum (FCS) 6ACF
LAPB:
Select a softkey, or [Okay] for the previous rack:
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
LAPB TRACE
display filters
FRAME DETAIL
find command

Figure HDLC-9 One Byte LAPB Frame Detail

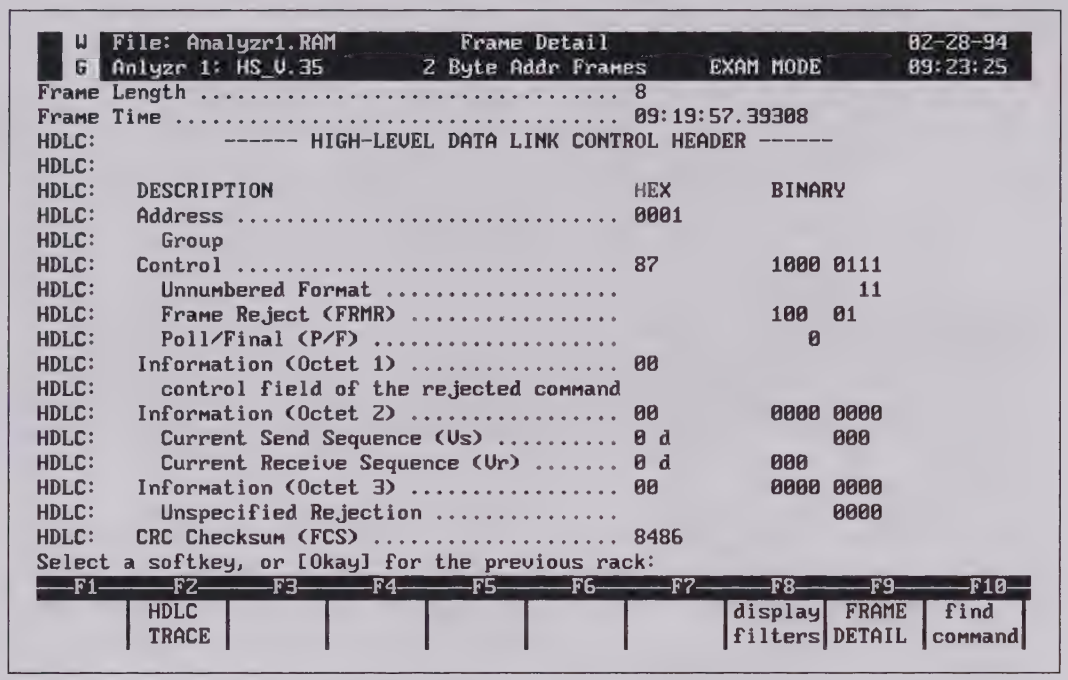

W File: Analyzr1.RAM Frame Detail 02-28-94
G Anlyzr 1: HS_V.35 2 Byte Addr Frames EXAM MODE 09:23:25
Frame Length 8
Frame Time 09:19:57.39308
HDLC: ------ HIGH-LEVEL DATA LINK CONTROL HEADER ------
HDLC:
HDLC: DESCRIPTION HEX BINARY
HDLC: Address 0001
HDLC: Group
HDLC: Control 87 1000 0111
HDLC: Unnumbered Format 11
HDLC: Frame Reject (FRMR) 100 01
HDLC: Poll/Final (P/F) 0
HDLC: Information (Octet 1) 00
HDLC: control field of the rejected command
HDLC: Information (Octet 2) 00 0000 0000
HDLC: Current Send Sequence (Vs) ..... 0 d 000
HDLC: Current Receive Sequence (Vr) ..... 0 d 000
HDLC: Information (Octet 3) 00 0000 0000
HDLC: Unspecified Rejection 0000
HDLC: CRC Checksum (FCS) 8486
Select a softkey, or [Okay] for the previous rack:
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
HDLC TRACE
display filters
FRAME DETAIL
find command

Figure HDLC-10 Two Byte HDLC FRMR Frame

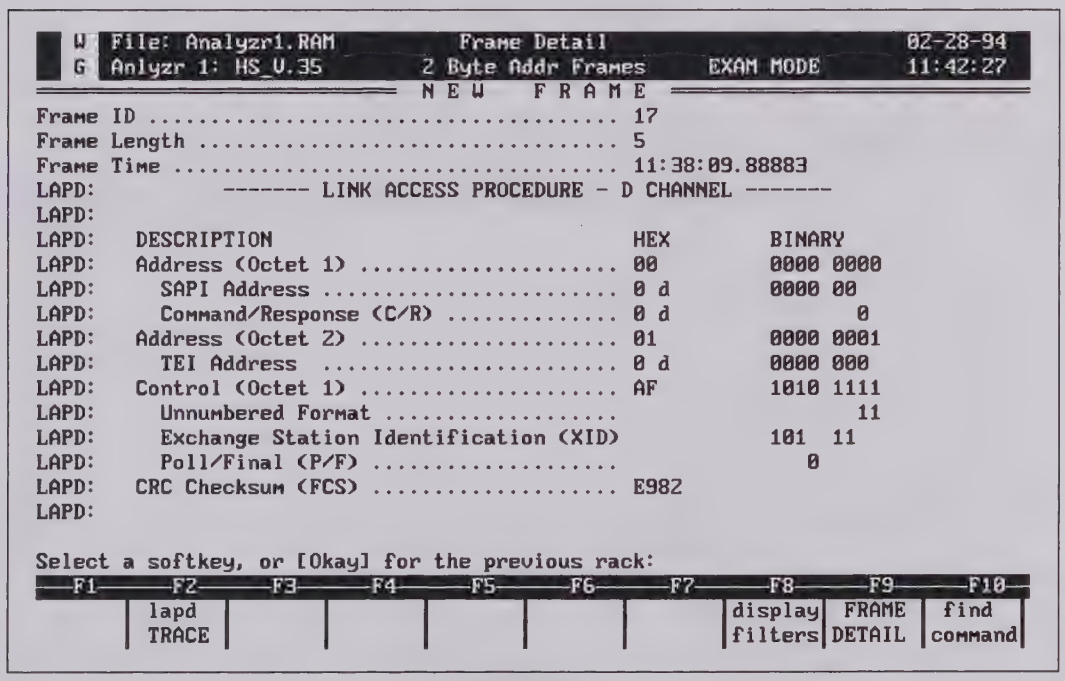

W File: Analyzr1.RAM Frame Detail 02-28-94
G Anlyzr 1: HS_V.35 2 Byte Addr Frames EXAM MODE 11:42:27
NEW FRAME
Frame ID 17
Frame Length 5
Frame Time 11:38:09.88883
LAPD: ------- LINK ACCESS PROCEDURE - D CHANNEL -------
LAPD:
LAPD: DESCRIPTION HEX BINARY
LAPD: Address (Octet 1) 00 0000 0000
LAPD: SAPI Address ..... 0 d 0000 00
LAPD: Command/Response (C/R) ..... 0 d 0
LAPD: Address (Octet 2) 01 0000 0001
LAPD: TEI Address ..... 0 d 0000 000
LAPD: Control (Octet 1) ..... AF 1010 1111
LAPD: Unnumbered Format 11
LAPD: Exchange Station Identification (XID) 101 11
LAPD: Poll/Final (P/F) 0
LAPD: CRC Checksum (FCS) E982
LAPD:
Select a softkey, or [Okay] for the previous rack:
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
lapd TRACE
display filters
FRAME DETAIL
find command

Figure HDLC-11 Two Byte LAPD Frame

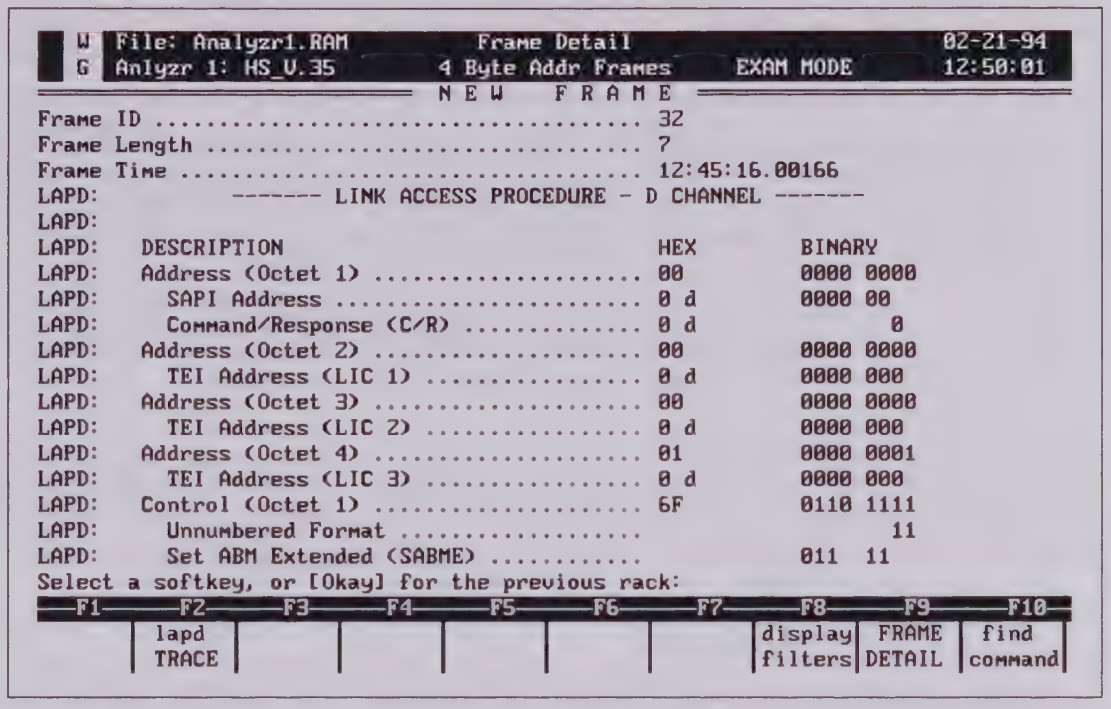

W File: Analyzr1.RAM Frame Detail 02-21-94
G Anlyzr 1: HS_V.35 4 Byte Addr Frames EXAM MODE 12:50:01
NEW FRAME
Frame ID 32
Frame Length 7
Frame Time 12:45:16.00166
LAPD: ------- LINK ACCESS PROCEDURE - D CHANNEL -------
LAPD:
LAPD: DESCRIPTION HEX BINARY
LAPD: Address (Octet 1) 00 0000 0000
LAPD: SAPI Address ..... 0 d 0000 00
LAPD: Command/Response (C/R) ..... 0 d 0
LAPD: Address (Octet 2) 00 0000 0000
LAPD: TEI Address (LIC 1) ..... 0 d 0000 000
LAPD: Address (Octet 3) 00 0000 0000
LAPD: TEI Address (LIC 2) ..... 0 d 0000 000
LAPD: Address (Octet 4) 01 0000 0001
LAPD: TEI Address (LIC 3) ..... 0 d 0000 000
LAPD: Control (Octet 1) 6F 0110 1111
LAPD: Unnumbered Format 11
LAPD: Set ABM Extended (SABME) 011 11
Select a softkey, or [Okay] for the previous rack:
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
lapd TRACE
display filters
FRAME DETAIL
find command

Figure HDLC-12 Four Byte LAPD Frame

Note:

The Frame Detail screen does not display the Ethertype decode—whether Ethernet encapsulation is operating or not.

The Frame Detail expands the decoding of the Address, Control and FCS fields of the frame. These fields are all the same except where noted. See Figure HDLC-13.

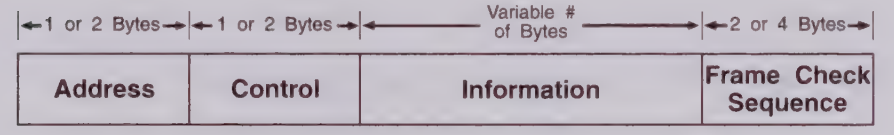


Figure HDLC-13 DLC Protocols Frame

HDLC.3.1. Address Field

HDLC Addressing:

The address field is in hexadecimal, which is the normal format for DLC addresses. HDLC assigns the designation “No Station” to address 00 and you can use this address for testing purposes. The DA-3x interprets 00 as “No Station.” If you broadcast the address (FF), the word "Broadcast" indicates this. You can assign any other address to one or more stations as a group address and the DA-3x interprets it as “Group.”

In command frames, the address field identifies the station(s) that is to receive the command. In response frames, the address field identifies the station that originates the response. The address field can be one or two bytes.

LAPB Addressing:

Even though the LAPB address field allows for 8 bits (256 possible addresses), the protocol is a single point-to-point link, and the only valid addresses are DTE = 00000011 and DCE = 00000001. Should the DTE or DCE encounter frames with addresses other than those defined, they will discard the frames. (See Multilink Option).

LAPD Addressing:

LAPD uses two address octets that gives LAPD multiplexing capability that LAPB and HDLC do not have. The first address octet contains the Service Access Point identifier (SAPI) which identifies the service on the D-channel and course addressing of 64 (6 bits) potential services.

The second address octet contains the Terminal Endpoint Identifier (TEI) which can identify up to 128 (7 bits) virtual terminals within one of 64 possible services on the D-channel. To achieve maximum possible addresses using this scheme there can be many TEI’s with the same address as long as there are not two within the same SAPI. The maximum number of individual addresses is 8192 connections (64 services x 128 terminals/service). The SAPI ADDR field uses the Command/Response (CR) bit to identify whether the frame is a command or response frame.

HDLC.3.2. Control Field

The control field contains commands or responses and sequence numbers. This field conveys a command to the addressed station to perform a particular operation. The field also conveys a response to such a command from the addressed station.

The control field identifies the frame as one of the following types:

Information	The values of Ns, P/F, and Nr display.
Supervisory	The values of the Supervisory frame type, P/F, and Nr display.
Unnumbered	The frame type and P/F display.

Tables HDLC-6 and HDLC-7 show the control field encoding patterns for Modulo 8 and Modulo 128.

Format\Bit:	8	7	6	5	4	3	2	1
Information	N(r)			P/F	N(s)			0
Supervisory	N(r)			P/F	e	e	0	1
Unnumbered	e	e	e	P/F	e	e	1	1
e = encoding bit (see First Control Byte Encoding Table HDLC-8)								

Table HDLC-6 Modulo 8 Control Field Encoding Patterns

Format\Bit:	8	7	6	5	4	3	2	1	Byte Number
Information				N(s)				0	1st Control Byte
				N(r)				P/F	2nd Control Byte
Supervisory	r	r	r	r	e	e	0	1	1st Control Byte
				N(r)				P/F	2nd Control Byte
*Unnumbered	e	e	e	u	e	e	1	1	1st Control Byte
(HDLC Old Scheme only)	r	r	r	r	r	r	r	P/F	2nd Control Byte
* Unnumbered LAPB and LAPD frames use Modulo 8 encoding e = encoding bit (see First Control Byte Encoding Table HDLC-8) r = reserved, should be set to 0 u = unspecified									

Table HDLC-7 Modulo 128 Control Field Encoding Patterns

Table HDLC-8 provides control byte encoding by frame type.

Format	Name	Encoding	HDLC	LAPB	LAPD	Function
Information	INFO	xxxxxxx0	C	C	C	Numbered Information
Supervisory	RR	xxxx0001	C/R	C/R	C/R	Receiver Ready
	RNR	xxxx0101	C/R	C/R	C/R	Receiver Not Ready
	REJ	xxxx1001	C/R	C/R	C/R	Reject; Go back N
	SREJ	xxxx1101	C/R			Selects Reject
Unnumbered	SNRM	100x0011	C			Set Normal Response Mode
	SNRME	110x1111	C			SNRM Extended
	SARM	000x1111	C			Set Async Response Mode
	SARME	010x1111	C			SARM Extended
	SABM	001x1111	C	C*		Set Async Balanced Mode
	SABME	011x1111	C	C**	C	SABM Extended
	SIM	000x0111	C			Set Initialization Mode
	RIM	000x0111	R			Request Initialization Mode
	DISC	010x0011	C	C	C	Disconnect; Terminate Connection
	DM	000x1111	R	R	R	Disconnected Mode
	RD	010x0011	R			Request Disconnect
	UA	011x0011	R	R	R	Unnumbered Acknowledge
	UI	000x0011	C/R		C	Unnumbered Information
	UP	001x0011	C			Unnumbered Poll
	RSET	100x1111	C		C***	Reset N(r), N(s)
	XID	101x1111	C/R		C/R	Exchange Identification
	TEST	111x0011	C/R		C/R***	Test Command/Response
	FRMR	100x0111	R	R	R	Frame Reject

x = not relevant for identifying frame type C/R = command/response
*Mod 8 only **Mod 128 only ***Four byte addressing only

Table HDLC-8 First Control Byte Encoding

HDLC.3.3. Information Field

This field is present in the following types of frames:

INFO Numbered Information frames

UI Unnumbered Information frames

FRMR Frame Reject frames

Information on this field by frame type is provided in the following sections.

HDLC.3.3.1. INFO and UI Frame Information Fields

In INFO and UI frames, the Information Field is the Protocol Data Unit (PDU) for the next protocol in the protocol stack. This PDU is simply passed up to the next protocol.

HDLC.3.3.2. FRMR Frame Information Fields

If a secondary station DTE or DCE receives an invalid command, it uses the Frame Reject frame (FRMR) to report an error condition not recoverable by retransmission of the identical frame. Such errors are the receipt of a frame with a command or response that is invalid or unimplementable, a frame that is or contains a field that is of the incorrect length, or N(R), N(s) sequence numbers out of range.

The Information field of the FRMR frame contains additional control information. The format depends on the current modulo, as shown in the following sections.

Modulo 8:

The first octet of the information field shows the current values of the send and receive counters (Vs and Vr) for the node transmitting the FRMR. Figure HDLC-14 illustrates the format for the LAPB FRMR information field for Modulo 8. The second octet interprets the reason(s) the transmitting node considered the frame that caused the FRMR to be invalid. Figure HDLC-15 illustrates the format for the LAPB FRMR information field for Modulo 128.

1 2 3 4 5 6 7 8	9	10 11 12	13	14 15 16	17	18	19	20	21	22	23	24
Rejected Frame Control Field	0	V(s)	C/R	V(r)	W	X	Y	Z	0	0	0	0

Figure HDLC-14 LAPB FRMR Information field (Modulo 8)

Modulo 128:

The first octet of the information field shows the current value of the send counter (Vs) for the node transmitting the FRMR as shown in Figure HDLC-15. The second octet shows the current value of the receive counter (Vr) for the node transmitting the FRMR. The third octet interprets the reason(s) the transmitting node considered the frame that caused the FRMR to be invalid. Figure HDLC-15 illustrates the format for the LAPB FRMR information field for Modulo 128.

1 - 16	17	18 - 24	25	26 - 32	33	34	35	36	37	38	39	40
Rejected Frame Control Field	0	V(s)	C/R	V(r)	W	X	Y	Z	0	0	0	0

Figure HDLC-15 LAPB FRMR Information Field (Modulo 128)

Table HDLC-9 provides a description of the four types of reasons the transmitting node considered the frame to be invalid.

Reason Type	Description
W	An invalid or non-implemented command was received.
X	A prohibited information field was received.
Y	The buffer was overrun (the information field is too long).
Z	The received Nr count disagrees with the transmitted Ns.

Table HDLC-9 FRMR Causes

HDLC.3.4. Frame Check Sequence Field

The Frame Check Sequence (FCS) is a 16-bit sequence of bits calculated on the bits between the last bit of the opening flag of a frame and through the first bit of the FCS, exclusively.

Cyclic Redundancy Checking (CRC) determines the 16-bit sequence. CRC places the remainder from this division in the frame as the FCS field. The receiver of this frame performs the same division on the data stream it receives azxnd compares its calculated remainder with that of the FCS field of the frame. If the receivers' remainder and the FCS field are the same, the frame is good.

HDLC.3.5. Multilink Option

The optional MultiLink Procedure (MLP) performs data interchange over one or more SLP's in parallel between a DTE or DCEs. All information transfers over the SLP are in multilink frames conforming to one of the formats shown in Figures HDLC-16 and HDLC-17.

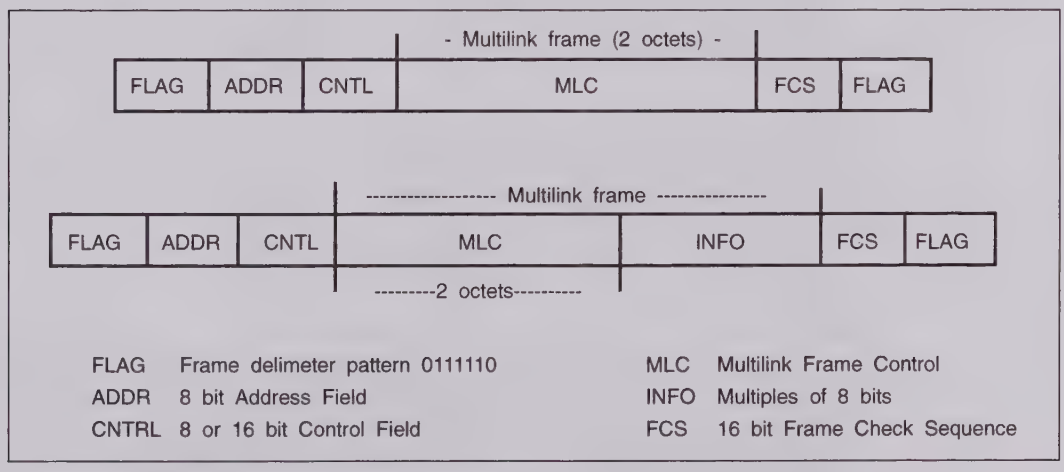


Figure HDLC-16 SLP Multilink Frame Formats

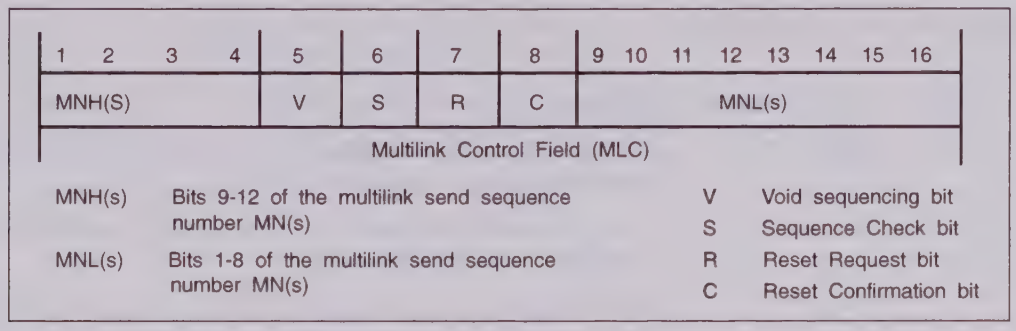


Figure HDLC-17 Multilink Control Field Format

HDLC.4. Find Commands and Display Filters

Table HDLC-10 provides the find commands for HDLC, LAPB, and LAPD.

Find Command Frame Types	HDLC	LAPB	LAPD
DISC	X	X	X
RD	X		
FRMR	X	X	X
INFO	X	X	X
REJ	X	X	X
RNR	X	X	X
RR	X	X	X
RSET	X		
SABM	X	X	
SABME	X	X	X
SARM	X		
DM	X	X	X
SARME	X		
SIM/RIM	X		
SNRM	X		
SNRME	X		
SREJ	X		
TEST	X		
UA	X	X	X
UI	X		X
UP	X		
XID	X		X

Table HDLC-10 Find Command Frame Types

There are no display filters available for HDLC, LAPB, or LAPD.

Glossary of DLC Frame Types

Frame Type	Meaning
DISC	Disconnect frame. A notification to a secondary station that it is being placed in disconnect mode.
DM	Disconnected Mode frame. A frame sent by a secondary station to indicate that it is in disconnected mode.
FRMR	Frame Reject frame that occurs with the receipt of an invalid frame (an invalid frame has a correct checksum, but impossible semantics). FRMR frames contain an information field reporting on the station's status.
INFO	Information frame.
RD	Request Disconnect. A request from a secondary station to be placed in disconnect mode.
REJ	Reject frame or retransmission request.
RIM	Request Initialization Mode. A frame transmitted by a secondary node to inform the primary station of the need for a SIM frame.
RNR	Receive Not Ready frame.
RR	Receive Ready frame.
RSET	Reset frame, clears the effect of an FRMR frame and resets the values of Nr and Ns.
SABM	Set Asynchronous Balanced Mode. A command that any station can use to set Asynchronous Balanced Mode. This frame operates in Modulo 8 DLC implementations.
SABME	Set Asynchronous Balanced Mode Extended. A command that any station can use to set Asynchronous Balanced Mode. This frame operates in Modulo 128 DLC implementations.
SARM	Set Asynchronous Response Mode frame. A command to set the response mode to Asynchronous Response Mode. This frame operates in Modulo 8 DLC implementations.
SARME	Set Asynchronous Response Mode Extended frame. A command to set the response mode to Asynchronous Response Mode. This frame operates in Modulo 128 DLC implementations.
SIM	Set Initialization Mode frame. This frame initializes link-level functions between the primary and secondary stations.
SNRM	Set Normal Response Mode frame. A command from the host to set the secondary in Normal response Mode. This frame operates in Modulo 8 DLC implementations.
SNRME	Set Normal Response Mode Extended frame. A command from the host to set the secondary in Normal Response Mode. This frame operates in Modulo 128 DLC implementations.
SREJ	Selective Reject frame or retransmission request.
TEST	A Test frame that exchanges identical test patterns within the Information fields for testing.
UA	Unnumbered Acknowledgment frame. A positive response to a set-mode command.

UI	Unnumbered Information frame. A frame that transmits information without sequence numbers.
UP	Unnumbered Poll frame. A poll frame that solicits control information.
XID	Exchange Identification frame. A frame that exchanges information between two stations.

Fourth Edition March 1994 Release 3.4.2 and after

HDLC/LAPB/LAPD

High-Level Data Link Control PAL References

HDLC.1. Introduction

This document explains the protocol-specific Protocol Analysis Language (PAL) keywords included in Version 1.6 of the HDLC Layer Protocol Package. This includes HDLC and two subsets, LAPB (Link Access Procedure B Channel) and LAPD (Link Access Procedure D Channel). We will refer to this group of three protocols as the DLC protocols. Release Notes will address any changes affecting this programming information. The *DA-30/31 Protocol Operating Information* binder includes HDLC, LAPB, and LAPD operating information.

The *DA-30/31 Programming Reference Manual* and the "Network Event Program" chapter of the *DA-30/31 Operating Manual* provide additional information about PAL and the Network Event Program. The preface to this binder contains directions for installing the LPP on your hard disk and instructions for loading the protocols on the protocol stack. Figure HDLC-1 provides a guide to information in the DA-30/31 document set.

The DLC protocol PAL keywords in this Layer Protocol Package allow you to write protocol-specific Network Event programs and apply them to DLC applications. The Network Event Program Editor simplifies this process with the softkey-guided mode. You can use the DLC keywords by themselves or in combination with core conditions within an event.

Protocol-specific keywords are different from core keywords because they are dependent on the presence of protocol software on the mainframe. However, it is acceptable to mix core and protocol-specific keywords within an event, e.g.,

```
COND RCVD RSET
     COUNTER rset.count = 50
ACTN ALARM
     ENHANCE.FRAME
```

In this example, RCVD RSET is a protocol-specific condition keyword ANDed with COUNTER which is a core condition keyword. ENHANCE.FRAME is a protocol-specific action keyword ANDed with ALARM which is a core action keyword. Chapter 4, "Language References" of the *Programming Reference Manual* provides references for core keywords. The end of this section includes a Backus-Naur Form (BNF) definition for High-level Data Link Control protocol-specific keywords.

DLC PAL keywords are available in the Network Event Program Editor only at the layer where the DA-3x loads DLC protocols in the protocol stack. DLC protocols are Layer 2 protocols. However, the custom stack softkey (F2) lets you choose the layer at which to load a protocol. Although you can choose the layer, it must appear in the stack in the correct order from lowest

to highest layer relative to other protocols. If you load a higher layer protocol beneath a lower layer protocol (for example, a Layer 4 protocol beneath a Layer 3 protocol), the instrument does not decode the higher layer protocol. You must load physical layer protocols at the bottom layer of the stack for proper functioning.

HDLC.2. Condition Keywords

This section provides references for the DLC condition keywords. It presents the keywords alphabetically with a syntactical model, description, type and an example for each. The syntactical model explains which parameters are necessary or optional for use with the keyword. Some keywords include additional remarks to explain special conditions or exceptions.

Each condition keyword is one of two types: external or internal. An external condition is an action that originates outside the program, such as a keystroke from the keyboard, a frame from the network, a trigger or a time-out. An internal condition originates within the program, as when an accumulator or counter reaches a certain value or a flag variable tests as set or reset. The logical negation of an external condition (an external condition with NOT) is also internal. With few exceptions, most interface-specific conditions are external since they originate from a frame.

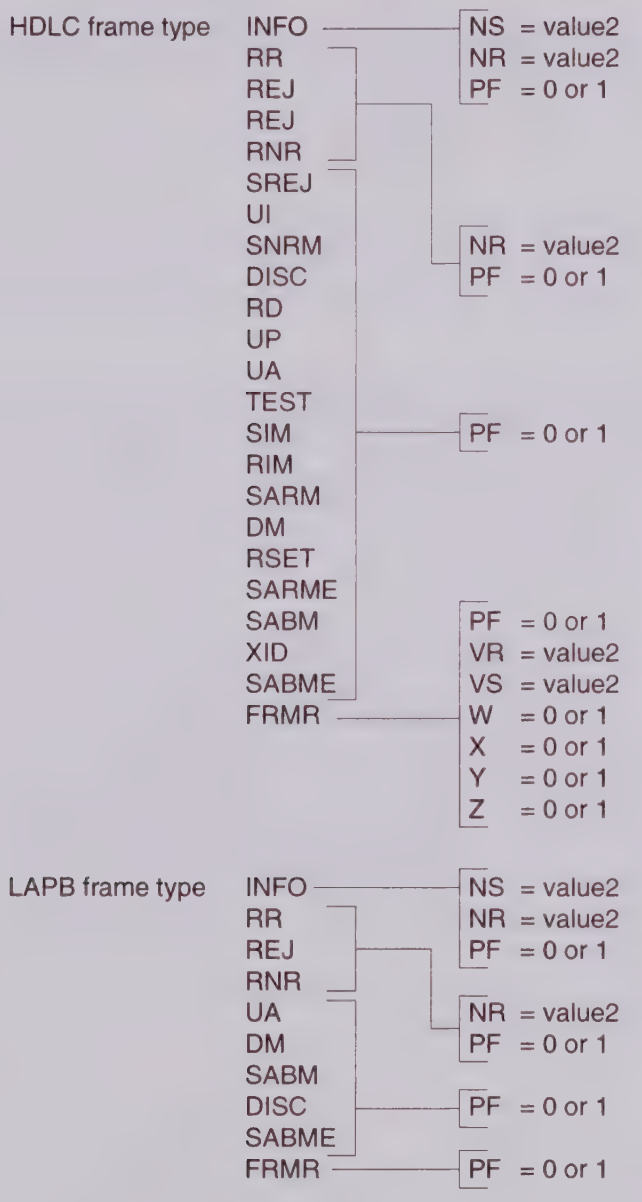
Examples demonstrate the operation of the keyword. Conditions fulfill the role of a THEN in an IF-THEN statement. The PAL statement COND x means if x becomes true. Variable names and values shown in the examples are arbitrary. They suggest programming possibilities, but do not constitute a total program and do not reflect a real application.

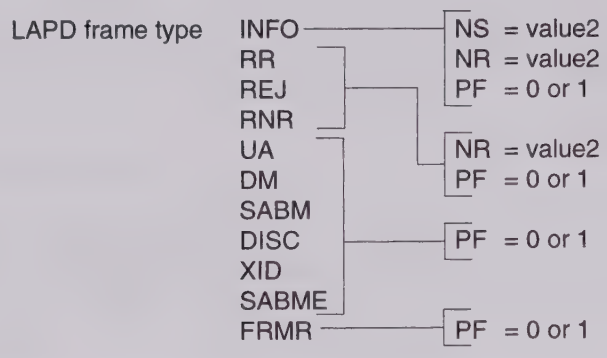
The condition keywords available with the DLC LPP are:

- RCVD
- RCVD.LONG
- RCVD.BAD.FCS
- RCVD.SHORT
- RCVD.INVALID

RCVD

Syntax: RCVD ADDR = value1





value1 an integer value between 0 and 255 (1 byte Address) or between 0 and 65535 (2 byteAddress), usually in hexadecimal.

value2 an integer value between 0 and 7 (Modulo 8) or between 0 and 127 (Modulo 128).

Description: The RCVD condition becomes true when a node receives a frame that matches the specified parameters. The address parameter refers to the address of the secondary node that is receiving the frame or that is sending the frame to the primary station. The HDLC section of the *DA-30/31 Protocol Operating Information* manual explains and matches each frame type by the parameter with the corresponding name.

- For Information format (INFO) frames, you may specify a value for the Ns counter, the Nr counter and the Poll/Final bit (0 or 1).
- For DLC Supervisory format frames (RR, RNR, REJ and SREJ), you may specify a value for the Nr counter and the Poll/Final bit (0 or 1).
- For Unnumbered format frames, you may specify a value for the Poll/Final bit (0 or 1).
- For FRMR frames, the program can match the values of Nr, Ns and W, X, Y and Z when transmitting them as part of the Information field of the FRMR frame.
- For address Ns and Nr, you may specify values either in decimal or hexadecimal. Use a preceding # symbol to identify hexadecimal numbers.
- You may specify parameters singly or in combinations. When using combinations, logically AND them.
- You can also use RCVD with no parameters, in which case the condition is true for all valid DLC protocol frames.

Type: External.

Example:

```
COND RCVD FRMR
ACTN ALARM

COND RCVD ADDR = #01  SABM
ACTN PROMPT "User 01 is setting Asynch Balanced Mode"
     MARK.FRAME
```

Remarks: None.

RCVD.BAD.FCS

Syntax: RCVD.BAD.FCS

Description: The RCVD.BAD.FCS condition becomes true when a node receives a frame with a bad Frame Check Sequence. You cannot use any additional parameters with this condition.

Type: External

Example:

```
COND RCVD.BAD.FCS
ACTN INC err.count
     PROMPT.TRACE "Frame with bad FCS received."
```

Remarks: A frame with a bad Frame Check Sequence is not a valid frame in accordance with the requirements of the protocol. As a result, the bits that the protocol trace might otherwise interpret as address, type, values for Nr, Ns, P/F and so forth are not recognizable to the protocol trace or to the Network Event Program. In the same event, a condition from a frame with a bad FCS and one from a valid frame cannot become true together. For instance, the following pair is never true together:

```
COND RCVD.BAD.FCS
     RCVD ADDR = #FF
```

You may view the address field of frames with bad checksums in the DA-30 Character Trace or Frame Detail. Use a find command in Examine Mode to locate the bad FCS frames within the Protocol Trace, and then switch to the Frame Detail or Character Trace to view the address field. You may also find a frame with a bad Frame Check Sequence in the Character Trace screen by using a Find Command within Examine Mode. However, a frame with a bad FCS may be corrupt, so bear in mind the possibility that the data the Character Trace or Frame Detail screen reports may be inaccurate.

RCVD.INVALID

Syntax: RCVD.INVALID

Description: The RCVD.INVALID condition becomes true when a node receives a frame that has a good FCS, but is semantically impossible. You cannot use any additional parameters with this condition.

Type: External.

Example:

```
COND RCVD.INVALID
ACTN INC invalid.count
     ALARM
```

Remarks: Neither the protocol trace nor the Network Event Program can interpret invalid frames. In the same event, a condition from an invalid frame and one from a valid frame cannot become true together. For instance, the following pair is never true together:

```
COND RCVD.INVALID
     RCVD P/F = 0
```

You may view the address field of invalid frame types in the DA-30 Frame Detail or Character Trace. Use a find command in Examine Mode to locate the invalid frames within the Protocol Trace, and then switch to the Character Trace or Frame Detail screen to view the address field.

RCVD.LONG

Syntax: RCVD.LONG

Description: The RCVD.LONG condition becomes true when a node receives a frame that is longer than the expected format for the frame type. Maximum values vary with the frame type, the modulo of the implementation, and with whether Extended Addressing is in use or not. Unnumbered format frame types UI, TEST, XID and FRMR may include a one- or two-byte Information field and are therefore longer than Supervisory frames or other types of Unnumbered format frames. Information format frames can include a variable number of 8-bit Information fields. You cannot use any other parameters with this condition.

Type: External.

Example:

```
COND RCVD.LONG
ACTN ENHANCE.FRAME
```

Remarks: Frames that are too long are invalid for protocol interpretation. Frame components such as address, the values of Nr, Ns and P/F and so forth are not recognizable by the protocol trace or by the Network Event Program. So, in the same event, a condition from a long frame and one from a valid frame cannot become true together. For instance, the following pair is never true together:

```
COND RCVD.LONG
     RCVD SREJ P/F = 1
```

You may view the address field of long frames in the DA-30 Character Trace. Use a find command in Examine Mode to locate the long frames within the Protocol Trace, and then switch to the Character Trace or Frame Detail screen to view the address field and remaining frame elements.

RCVD.SHORT

Syntax: RCVD.SHORT

Description: The RCVD.SHORT condition becomes true when a node receives a frame that is shorter than the expected format for the frame type. Minimum length values vary with the frame type, the modulo of the implementation, and whether Extended Addressing is in use or not. You cannot use any other parameters with this condition.

Type: External.

Example:

```
COND RCVD.SHORT
ACTN SET.FLAG short.flag
     PROMPT.TRACE "Short frame received."
```

Remarks: A frame that is too short is not a valid frame, in accordance with the requirements of the protocol. As a result, the bits that the protocol trace might otherwise interpret as address, type, values for Nr, Ns, P/F and so forth are not recognizable to the protocol trace or to the Network Event Program. A condition from a short frame and one from a valid frame cannot become true together (from the same event). For instance, the following pair is never true together:

```
COND RCVD.SHORT
     RCVD NR = #06
```

You may view the address field of short frames in the DA-30 Character Trace or Frame Detail screen. Use a find command in Examine Mode to locate the short frames within the Protocol Trace, and then switch to the Character Trace or Frame Detail to view the address field. Bear in mind the possibility that the data the Character Trace or Frame Detail screen reports may be inaccurate.

HDLC.3. Action Keywords

This section provides references for the High-level Data Link Control action keywords. The keywords are in alphabetical sequence with a syntactical model, description and an example for each. The syntactical model explains what parameters are necessary or optional for use with the keyword. Additional remarks accompany some keywords to explain special conditions or exceptions.

Examples demonstrate the use of the keyword. Actions fulfill the role of a THEN in an IF-THEN statement. The PAL statement ACTN x means then execute x. Variable names and values shown in the examples are entirely arbitrary. They suggest programming possibilities, but do not constitute a total program and do not reflect a real application.

The action keywords available with DLC protocols are:

- ENHANCE.FRAME
- SEND
- SUPPRESS.FRAME

ENHANCE.FRAME

Syntax: ENHANCE.FRAME

Description: The ENHANCE.FRAME action highlights a frame in the Protocol Trace with reverse video and identifies it for later use with the find commands feature in DA-30 Examine Mode. In Run Mode a frame appears in reverse video in the Protocol Trace at the layer that uses the ENHANCE.FRAME keyword. Further, the criteria of ENHANCED can search for that frame in the file created for Examine Mode operations.

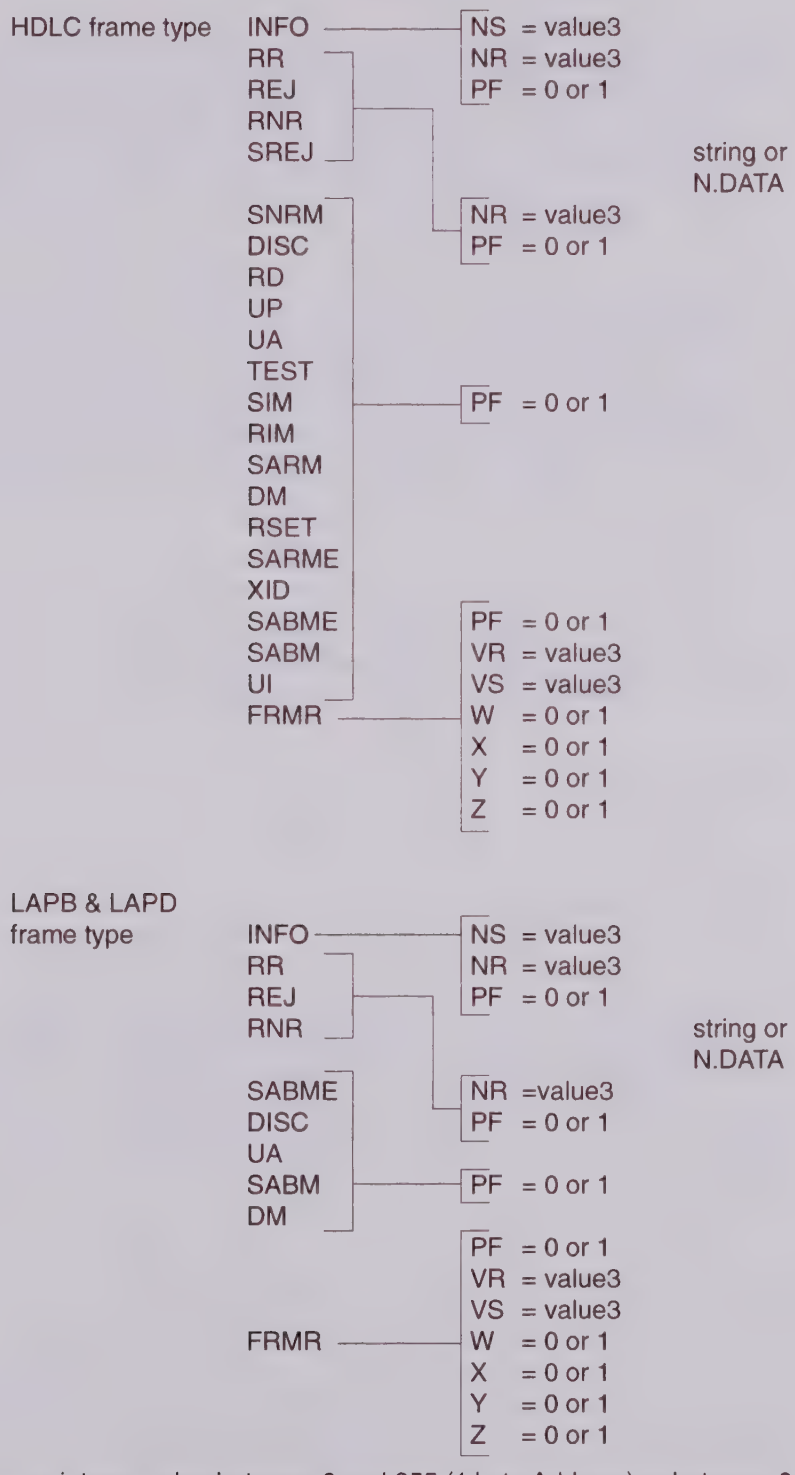
Example:

```
COND RCVD  SNRM  PF = 1
ACTN ENHANCE.FRAME
```

Remarks: In order to execute an ENHANCE.FRAME action, the program must be processing a frame, not a key from the keyboard, or a time-out variable expiration, etc. Therefore, there are limits on the types of conditions that successfully execute the ENHANCE FRAME action. Condition statements that deal with frames, or specific parameters of frames, such as the example given above, are valid. It is not possible to enhance a frame from an ANY.KEY condition or a time-out, trigger, etc.

SEND

Syntax: SEND ADDR = value1 PATH = value2



value1 an integer value between 0 and 255 (1 byte Address) or between 0 and 65535 (2 byte Address), usually expressed in hexadecimal.

value2 an integer value between 0 and 65535.

SEND (cont.)

value3 an integer value between 0 and 7 (Modulo 8) or between 0 and 127 (Modulo 128).

string a valid string, enclosed in " ".

Description: The SEND action transmits a frame with the referenced parameters from the DLC program layer to program layer 1. From there you can send the frame into the interface and out onto the network. The Path parameter allows Layer 1 to distinguish the source of the data. The address parameter specifies the address of the secondary station that the frame uses. You can specify each DLC frame type. The DLC Trace section of the *DA-30/31 Protocol Operating Information* manual explains these types.

- For Information format frames, you may specify a value for the Ns counter, the Nr counter and the Poll/Final bit.
- For Supervisory format frames (RR, RNR, REJ and SREJ), you may specify the Nr counter and the Poll/Final bit (0 or 1).
- For Unnumbered format frames, you may specify the Poll/Final bit (0 or 1).
- You can specify the values of Nr and Ns for FRMR frames, which the Information field of the frame uses as VR and VS parameters.
- You can also specify values for W, X, Y and Z (either 0 or 1). Values for the address, Ns and Nr can be either in decimal or hexadecimal.

Use a preceding # symbol to identify hexadecimal numbers. For frame types INFO and UI you may specify a string or N.DATA primitive (the layer 3 Protocol Data Unit) as additional data. You may specify parameters singly or in combinations.

Example:

```
COND DATA.FROM.UP
ACTN SEND ADDR = #03 INFO N.DATA

COND KEY "1"
ACTN SEND FRMR   W = 0  Y = 0  Z =0
     PROMPT "Sending FRMR frame with status X."
```

Remarks: To run an application using the DLC SEND keyword in a PAL program, the Test Mode field in the DA-30's Main Menu slot window must specify Emulate. In order to send data of type N.DATA, the program must be processing this type of data, not a key from the keyboard, or a trigger, etc. Condition statements that deal with this type of data, such as the example given above, are valid. It is not possible to send N.DATA from an ANY.KEY condition or a time-out, trigger, etc.

SUPPRESS.FRAME

Syntax: SUPPRESS.FRAME

Description: The SUPPRESS.FRAME action suppresses a frame from the Character and Protocol Trace displays from capture and logging, and from use in the Network Event Program. This capability is similar to the layer filter functions, but allows selective suppression of frames based on core or protocol-specific criteria.

Example:

```
COND RCVD INFO
ACTN SUPPRESS.FRAME
```

Remarks: In order to execute a SUPPRESS.FRAME action, the program must be processing a frame, not a key from the keyboard, or a time-out variable expiration, etc. Therefore, there are limits on the types of conditions that successfully execute the SUPPRESS.FRAME action. Condition statements that deal with frames, or specific parameters of frames, such as the example given above, are valid. It is not possible to suppress a frame from an ANY.KEY condition or a time-out, trigger, etc.

HDLC.4. PAL BNF Definitions

The following BNF definitions for DLC keywords are as follows:

hdlc.pal.statement ::= hdlc.condition | hdlc.action

lapb.pal.statement ::= lapb.condition | lapb.action

lapd.pal.statement ::= lapd.condition | lapd.action

hdlc.condition
lapb.condition
lapd.condition ::= RCVD [rcvd.modifier] | error.cond

rcvd.modifier ::= { [ADDR=integer][frame.detail] } any

error.cond ::= RCVD.SHORT | RCVD.BAD.FCS | RCVD.INVALID | RCVD.LONG

frame.detail ::= INFO [info.type] | supervisory [supervisory.type]
| unnumbered [P/F=integer] | FRMR [frmr.type] |

info.type ::= { [NR=integer][NS=integer][P/F=integer] } any

supervisory
(HDLC/LAPD) ::= RR | RNR | REJ | SREJ
(LAPB) ::= RR | RNR | REJ

supervisory.type ::= { [NR=integer][P/F=integer] } any

unnumbered
(HDLC/LAPD) ::= UP | UI | SNRM | DISC | SIM | XID | TEST | SARM
| SARME | UA | RIM | DM | RD | RSET | SNRME | SABM | SABME
(LAPB) ::= DISC | UA | DM | SABM

frmr.type ::= { [P/F=integer][VR=integer][VS=integer][W=integer][X=integer]
[Y=integer][Z=integer] } any

hdlc.action
lapb.action
lapd.action ::= SEND [PATH = integer] send.modifier | ENHANCE.FRAME
| SUPPRESS.FRAME

send.modifier ::= { [ADDR=integer] send.type} any

send.type ::= INFO send.info.type | supervisory [send.supervisory.type]
| unnumbered.non.data [P/F=integer] | UI ui.type
FRMR frmr.type

send.info.type ::= { [NR=integer][NS=integer][P/F=integer][string | N.DATA] } any

send.supervisory.type ::= { [NR=integer][P/F=integer] } any

ui.type ::= { [P/F=integer][string | N.DATA] } any

unnumbered.non.data ::= UP | SNRM | DISC | SIM | XID | TEST | SARM | SARME
| UA | RIM | DM | RD | RSET | SNRME | SABM | SABME

Notes:

1) The term "any" implies that items between "{" and "}" can appear in any order.

2) For definitions of "string" and "integer" refer to BNF definition for core PAL keywords.

Fourth Edition October 1993 Release 3.4 and after

SDLC

Synchronous Data Link Control Protocol Operation

SDLC.1. Introduction

This document describes the protocol-specific operation of the DA-3x with Version 1.1 of the SDLC Layer Protocol Package. Any changes affecting this operating information will be addressed in Release Notes.

Information on installing an LPP on the DA-3x, loading a protocol on the protocol stack, monitoring and examining network traffic, searching for specific frames, and filtering captured traffic is provided in the preface to this manual.

SDLC.1.1. Introduction to SDLC

Synchronous Data Link Control is the IBM standard for Data Link layer operations in Wide Area Networks. It has the overall responsibility for managing synchronous, code-transparent, serial-by-bit information transfer between nodes that are joined by data links. SDLC manages line discipline, interprets commands, generates responses, controls data flow and manages error control and recovery functions.

In Wide Area Network topologies, data links are either point-to-point (two stations on a link) or multi-point (more than two station per link). Line discipline is simple in point-to-point environments; the two nodes establish which is to transmit, which is to receive, and that the receiver to ready to receive. Next, data is transmitted in one or more acknowledged blocks. When the transmission is complete, the transmitter-receiver relationship is terminated. In multi-point configurations, access to the data link must be managed; one station acts as a primary (usually called the host) and the other stations are secondary (usually terminals). The primary station controls the access of the secondary stations to the transmission carrier by a scheme known as polling; each secondary node must wait until it is polled before it can transmit. The primary station informs the secondaries that it has data to transmit by a function called select. Both the polling and select functions require that all stations have addresses; the host manages network access by this address, which is one portion of the SDLC frame. Other aspects of line discipline managed at this layer are determined by whether the link is half- or full-duplex, that is, whether data transmission can occur only in one direction at a time (half-duplex) or in both directions simultaneously (full-duplex). SDLC can also be used with simplex transmission, where data flow is always in one direction; these are called SDLC Loop Configurations.

There are three formats of SDLC frames:

- Supervisory — frames which indicate the state of the transmitter-receiver. Supervisory frames include Receive Ready, Reject, and Receive Not Ready.
- Information — frames which transmit data.
- Unnumbered — control frames which are used for initialization, polling and status reporting. Some of these frames contain a variable-size Information field for the control information.

Each frame begins with a one-Byte flag, which alerts the receiver to the frame's presence. The address field (one or two Bytes) is the next frame component, followed by a control Byte with optional Information field (one or more Bytes). After the higher-layer-protocol data, a two-Byte Frame Check Sequence (using a cyclic redundancy checksum) allows the receiving station to verify the accuracy of bit transmission. The frame ends with another one-Byte flag.

SDLC provides end-to-end verification and error recovery by sequencing and acknowledgement procedures. Each SDLC user maintains a Send Counter and Receive Counter, called Ns and Nr, for frames carrying information. Values for both Ns and Nr are transmitted as part of Information frames; Supervisory frames transmit a value for Nr; there is no Ns or Nr field in Unnumbered frames. The SDLC user checks the Nr and Ns values in the relevant frames against its internal counter values. If the values maintain proper sequencing and none are missed, the internal counters are updated. If the Nr and/or Ns values in the frame do not remain sequenced, the receiving SDLC user returns a negative acknowledgement, requiring the sending node to retransmit all frames which were sent since the last time the counter values were properly synchronized. To ensure that this type of verification is performed frequently, the acknowledgement process limits the number of frames that can be sent prior to an acknowledgement from the receiver. The limit is established in a buffer called a **window**; with each frame received, the pointer within the window advances. The size of the window varies with what is called the modulo of the SDLC version in use. Modulo 8 operation allows a maximum window size of 7; frames numbered 0 through 7 may be transmitted before the sending station expects a confirmation from the receiving station. Modulo 128 allows a window of 127 frames. When the maximum window value (127) is reached, the transmitting user sends no further frames until an acknowledgement is received.

Further information on the Synchronous Data Link Control protocol is available in the following references:

Stallings, W. *Handbook of Computer-Communications Standards, Volume I: The Open Systems Interconnection (OSI) Model and OSI-Related Standards* New York: Macmillan, 1987

International Business Machines Corporation. *Synchronous Data Link Control Concepts* North Carolina, 1986

SDLC.1.2. Completing the SDLC Configuration Menu

When you select SDLC as your Data Link Layer protocol, a configuration menu is available through softkey F4 to allow you to match the DA-30 to the particular implementation of SDLC you have on your network. Figure SDLC-1 shows the Configuration Menu for the SDLC protocol.

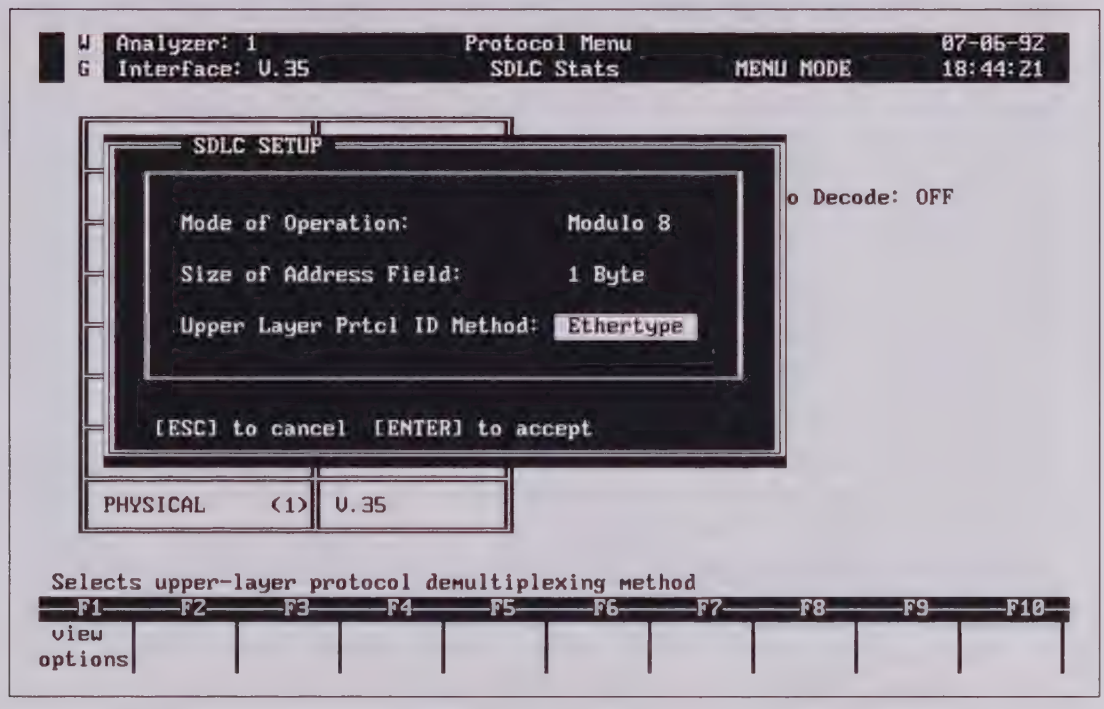


Figure SDLC-1 SDLC Configuration Menu

SDLC.1.2.1. Mode of Operation

SDLC is implemented on networks either in Modulo 8 or Modulo 128; the difference is the size of the acknowledgement window. In Modulo 8 networks, the SDLC sending entity may send only 7 Information format frames before the receiving entity must acknowledge at least some portion of them. In Modulo 128, up to 127 Information frames may be sent before the sending entity must receive an acknowledgement. Which modulo is in use affects the size of the control field in the SDLC frame; the DA-30 cannot decode the frames properly unless it knows which modulo is in use.

Your choices for Mode of Operation are Modulo 8 and Modulo 128. Move the cursor to the Mode of Operation field and press F1 to view the options. Select the mode appropriate to your network and press Enter to accept or Esc to return to the Configuration Menu screen. If you are not sure which modulo is in use in your network's implementation of SDLC, consult your network software vendor.

SDLC.1.2.2. Size of Address Field

SDLC supports either one- or two-Byte Address fields. The standard is one-Byte. If Extended Addressing is in use, the Address is a two-Byte format. The DA-30 cannot decode the frames properly unless it knows whether the Address field is one or two Bytes in length. Move the cursor to the Size of Address field and press F1 to view the options. Select the size appropriate to your network and press Enter to accept or Esc to return to the Configuation Menu screen. If you are not sure whether Extended Addressing is in use on your network or not, consult your network software vendor.

SDLC.1.2.3. Upper Layer Prtcl ID Method

The SDLC LPP supports 2-byte encapsulation of Ethernet and IEEE 802.3 frames. The Upper Layer Protocol Identification Method field allows you to select how the next upper layer protocol is identified. The choices are:

- Unknown — the protocol identification method is not known. SDLC operates normally—without the LAN encapsulation.
- Ethertype — Ethernet/IEEE 802.3 frames are encapsulated as shown in Figure SDLC-3. The first two bytes of the SDLC data field correspond to the Type/Length (Ethertype) field of these frames. The remainder of the Ethernet frame maps into the remainder of the SDLC data field.

  If IEEE 802.3 is the protocol being used, this field is referred to as the Length field—specifying the number of Logical Link Control (LLC) bytes contained in the data field. Length values range from 0000 to 05FF (hex). On the other hand, if Ethernet is the protocol being used, this field is referred to as the Type field—indicating the type of the next highest layer protocol (i.e. IP). Type values range from 0600 to FFFF (hex).

This field defaults to Unknown.

For more information about Ethernet/IEEE 802.3 or Type values and the protocols they represent, refer to the Ethernet section of the "Line Interfaces Operation" chapter in the *DA-30/31 Operating Manual.*

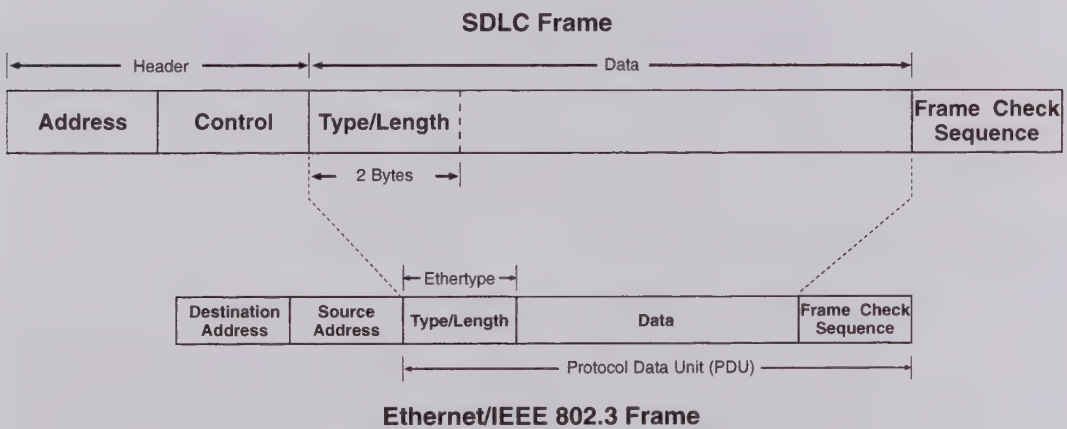


Figure SDLC-2 Ethernet Encapsulation within SDLC

SDLC.2. The SDLC Trace

Figure SDLC-3 shows the DA-30's trace for SDLC frames.

W File: SDLCCAP.V35 SDLC Summary 10-19-92
G Anlyzr 1: V.35 SDLC Monitor EXAM MODE 12:31:06

Frame #	DTE-DCE	Addr	Type	Nr	Ns	P/F	FCS	Size	Time
221	->	C2	SNRM	-	-	1	G	4	11:48:42.48460
222	<-	C2	UA	-	-	1	G	4	11:48:42.49072
223	->	C2	RR	0	-	1	G	4	11:48:44.89366
224	<-	C2	INFO	0	0	1	G	240	11:48:44.90054
225	->	C2	RR	1	-	0	G	4	11:48:45.01984
226	<-	C2	INFO	0	1	0	G	264	11:48:45.03798
227	<-	C2	INFO	0	2	1	G	128	11:48:45.21968
228	<-	C2	INFO	0	3	0	G	64	11:48:48.28451
229	<-	C2	INFO	4	0	0	G	16	11:48:48.29049
230	->	C2	INFO	4	1	1	G	248	11:48:50.95104
231	->	C2	INFO	4	2	1	G	72	11:48:50.96284
232	<-	C2	RR	3	-	1	G	4	11:48:51.18422
233	->	C2	DISC/RD	-	-	1	G	4	11:48:52.40604
234	<-	C2	UA	-	-	1	G	4	11:48:52.41296
235	<-	C2	DM	-	-	1	G	4	11:48:52.41644
236	->	C2	SNRM	-	-	1	G	4	11:48:52.42342
237	<-	C2	UA	-	-	1	G	4	11:48:52.54211

Select a softkey, or [Okay] for the previous rack:

F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
	SDLC TRACE						display filters	FRAME DETAIL	find command

Figure SDLC-3 SDLC Protocol Trace

Trace Fields

Frame # — the frame number, relative to the moment the DA-30 began to monitor frames.

DTE-DCE — indicates the direction of the frame, relative to the DTE (Data Terminal Equipment) and DCE (Data Communication Equipment).

Address — the address of the secondary station to which the frame is destined, or which is sending the frame.

Type — the frame type. SDLC frame types recognized by the DA-30 include:

- INFO — an Information frame.
- RR — Receive Ready frame.
- RNR — Receive Not Ready frame.
- REJ — Reject frame or retransmission request.
- UP — Unnumbered Poll frame, a poll frame used in Loop Configurations to resolve outstanding frame responses.
- UI — Unnumbered Information frame, a frame used for transmitting information without sequence numbers.
- SNRM — Set Normal Response Mode frame, a command to a secondary station to set it into Normal Response Mode. This frame is used in Modulo 8 SDLC implementations.
- DISC — Disconnect frame, a notification to a secondary station that it is being placed in disconnect mode.

SIM	Set Initialization Mode frame, used to initialize link-level functions between the primary and secondary stations.
XID	Exchange Identification frame, used to exchange information between two stations.
TEST	A Test frame; the information field may contain a test pattern.
CFGR	Configure, a frame used in Loop Configurations to exchange diagnostic information between a primary and secondary station.
UA	Unnumbered Acknowledgement frame, a positive response to a SNRM, DISC or SIM command.
RIM	Request Initialization Mode, a frame transmitted by a secondary node to inform the primary station of the need for a SIM frame.
DM	Disconnected Mode frame, a frame sent by a secondary station to indicate that it is in disconnected mode.
FRMR	Frame Reject frame, which occurs when an invalid frame is received (an invalid frame has a correct checksum, but impossible semantics). FRMR frames contain an information field reporting on the station's status.
RD	Request Disconnect, a request from a secondary station to be placed in disconnect mode.
BCN	Beacon frame, used in Loop Configurations to isolate link failures.
SNRME	Set Normal Response Mode Extended, a command to a secondary station to set it into Normal Response Mode. This frame is used in Modulo 128 SDLC implementations.

The bit-maps of the RIM and SIM frames are identical, as are the bit-maps of RD and DISC frames. It is apparent to the SDLC user (host or secondary) as to which frame type is intended when this bit pattern is received (only the host can send SIM and DISC frames, only a secondary station can send RIM and RD frames). Since the DA-30 has no way of knowing if the frame is going from host to secondary or from secondary to host, frames with this bit-pattern are reported as "SIM/RIM" and "DISC/RD" in the SDLC Protocol Trace.

Nr	the value of the Nr field, in Information or Supervisory frames. A dash is displayed for Unnumbered format frames.
Ns	the value of the Ns field, in Information frames. A dash is displayed for Supervisory or Unnumbered format frames.
P/F	Poll/Final bit; a poll bit is sent from the primary station to the secondary to require it to initiate transmission. A final bit is sent to the primary station by the secondary in the last frame of a transmission.
FCS	the value of the Frame Check Sequence is interpreted as either good or bad.
Size	the size (in Bytes) of the SDLC frame.
Time	the Timestamp of the frame.

Note:

When in the Run Mode, if Ethernet encapsulation has been enabled and an Ethernet PDU length error is detected during the decoding of Ethertype, no error message will be displayed. However, the bad PDU will not be passed to the upper layers.

SDLC.3. SDLC Frame Detail

The SDLC Frame Detail screen shows a hexadecimal and binary decode of each portion of the SDLC frame, and equates a text description with it. A sample SDLC Frame Detail is shown in Figure SDLC-4.

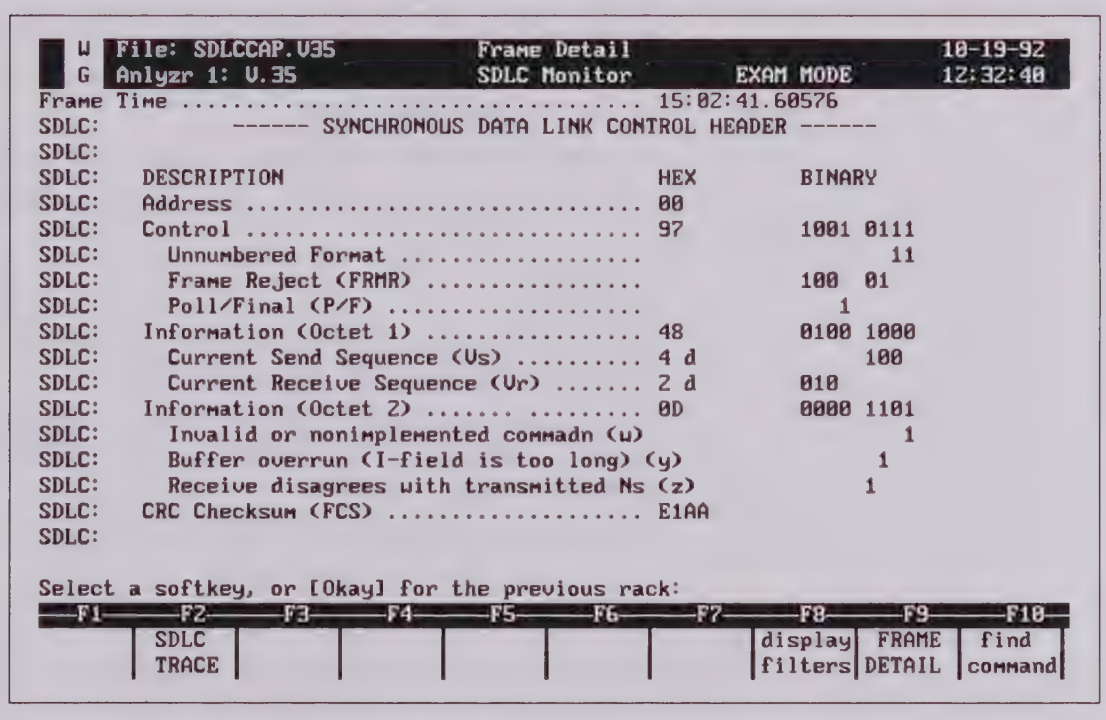

W File: SDLCCAP.V35 Frame Detail 10-19-92
G Anlyzr 1: V.35 SDLC Monitor EXAM MODE 12:32:40
Frame Time 15:02:41.60576
SDLC: ------ SYNCHRONOUS DATA LINK CONTROL HEADER ------
SDLC:
SDLC: DESCRIPTION HEX BINARY
SDLC: Address 00
SDLC: Control 97 1001 0111
SDLC: Unnumbered Format 11
SDLC: Frame Reject (FRMR) 100 01
SDLC: Poll/Final (P/F) 1
SDLC: Information (Octet 1) 48 0100 1000
SDLC: Current Send Sequence (Vs) ..... 4 d 100
SDLC: Current Receive Sequence (Vr) ..... 2 d 010
SDLC: Information (Octet 2) 0D 0000 1101
SDLC: Invalid or nonimplemented commadn (u) 1
SDLC: Buffer overrun (I-field is too long) (y) 1
SDLC: Receive disagrees with transmitted Ns (z) 1
SDLC: CRC Checksum (FCS) E1AA
SDLC:
Select a softkey, or [Okay] for the previous rack:
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
SDLC TRACE
display filters
FRAME DETAIL
find command

Figure SDLC-4 An SDLC Frame Detail Display

The SDLC Frame Detail expands the decoding of the Address, Control and FCS fields of the frame. See Figure SDLC-5.

Note:

The Frame Detail screen does not display the Ethertype decode—whether Ethernet encapsulation has been enabled or not.

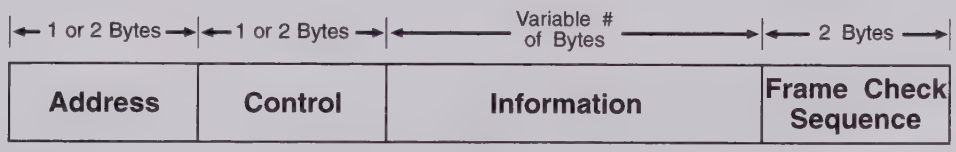


Figure SDLC-5 SDLC Frame

Address — The address field is given in hexadecimal, which is the normal format for SDLC addresses. If the address is broadcast (FF), this is indicated with the word "Broadcast."

Control — The Control field identifies the frame:

1) As one of the three frame formats (Information, Supervisory and Unnumbered)
2) If an Information format frame, the values of Ns and Nr are given.
3) If a Supervisory format frame, the value of Nr is given, and the Supervisory frame type is shown.
4) If an Unnumbered format frame, the frame type is shown.
5) If an FRMR frame, the values of the Information fields are decoded.

Modulo 8:

The first octet shows the current values of the send and receive counters (Vs and Vr) for the node transmitting the FRMR.

The second octet interprets the reason(s) the transmitting node considered the frame which caused the FRMR to be invalid. These are typed by the alpha characters W,X,Y and Z.

W invalid or non-implemented command received

X prohibited information field received

Y buffer overrun (information field is too long)

Z received Nr count disagrees with transmitted Ns

Modulo 128:

The first octet shows the current value of the send counter (Vs) for the node transmitting the FRMR.

The second octet shows the current value of the receive counter (Vr) for the node transmitting the FRMR.

The third octet interprets the reason(s) the transmitting node considered the frame which caused the FRMR to be invalid. These are typed by the alpha characters W,X,Y and Z:

W invalid or non-implemented command received

X prohibited information field received

Y buffer overrun (information field is too long)

Z received Nr count disagrees with transmitted Ns

6) The status and position of the Poll/Final bit is shown.
7) The value of the Frame Check Sequence is shown.

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SDLC

Synchronous Data Link Control PAL References

SDLC.1. Introduction

This document explains the protocol-specific PAL keywords included in Version 1.1 of the SDLC Layer Protocol Package. Any changes affecting this programming information will be addressed in Release Notes. Directions for installing the LPP on your hard disk and instructions for loading the protocols on the protocol stack can be found in the preface to this binder.

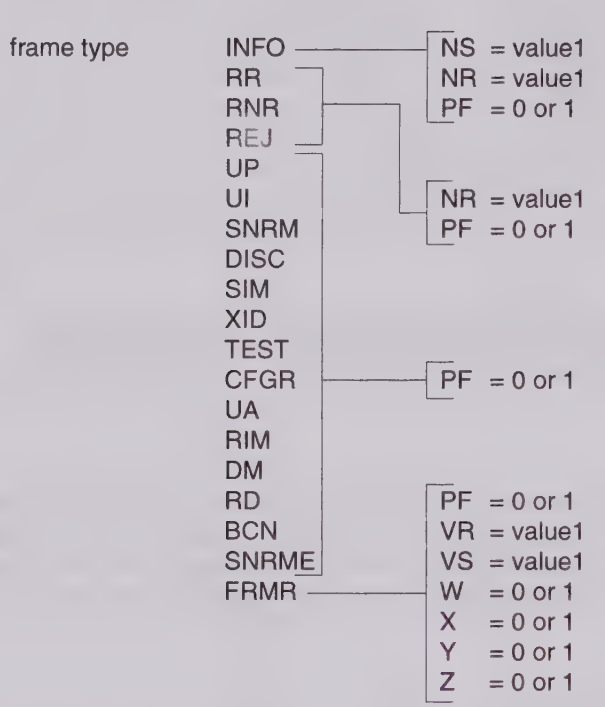
SDLC.2. Condition Keywords

This section provides references for the SDLC condition keywords. The keywords are presented alphabetically, with a syntactical model, description, type and an example for each. The syntactical model explains which parameters are necessary or optional for use with the keyword. Additional remarks are included with some keywords to explain special conditions or exceptions.

Each condition keyword is one of two types: external or internal. An external condition is something that comes from outside the program, such as a keystroke from the keyboard, a frame from the network, a trigger or a timeout. An internal condition is fulfilled from within the program, as when an accumulator or counter reaches a certain value or a flag variable tests as set or reset. The logical negation of an external condition (an external condition used with NOT) is also internal. With few exceptions, most interface-specific conditions are external, since they occur from a frame.

RCVD

Syntax: RCVD ADDR = value



value an integer value between 0 and 255 (1 Byte Address) or between 0 and 65535 (2 Byte Address), usually expressed in hexadecimal.

value1 an integer value between 0 and 7 (Modulo 8) or between 0 and 127 (Modulo 128).

Description: The RCVD condition becomes true when a frame is received which matches the specified parameters. The address parameter refers to the address of the secondary node to which the frame is addressed or which is sending the frame to the primary station. Each frame type is explained in the Trace Fields portion of the document section that accompanies the SDLC software; each frame type is matched by the parameter with the corresponding name. For Information format (INFO) frames, a value may be specified for the Ns counter, the Nr counter and the Poll/Final bit (0 or 1). For SDLC Supervisory format frames (RR, RNR and REJ), a value may be specified for the Nr counter and the Poll/Final bit (0 or 1). For Unnumbered format frames, a value may be specified for the Poll/Final bit (0 or 1). For FRMR frames, the program can match the values of Nr, Ns and W, X, Y and Z which are transmitted as part of the Information field of the FRMR frame. Values for address, Ns and Nr can be specified either in decimal or hexadecimal. Use a preceding # symbol to identify hexadecimal numbers. Parameters may be specified singly or in combinations. When used in combinations, they are logically ANDed. RCVD can also be used with no parameters, in which case the condition is true for all valid SDLC frames.

RCVD (cont.)

Type: External.

Example:

```
COND RCVD FRMR
ACTN ALARM

COND RCVD ADDR = #C4  SNRM
ACTN PROMPT "Station C4 is entering Normal Response Mode"
     MARK.FRAME
```

Remarks: None.

Synchronous Data Link Control PAL References DA-30/31 Protocol Programming Information

RCVD.BAD.FCS

Syntax: RCVD.BAD.FCS

Description: The RCVD.BAD.FCS condition becomes true when a frame with a bad Frame Check Sequence is received. No additional parameters can be used with this condition.

Type: External

Example:

```
COND RCVD.BAD.FCS
ACTN INC err.count
     PROMPT.TRACE "Frame with bad FCS received."
```

Remarks: A frame with a bad Frame Check Sequence is not a valid frame, in accordance with the requirements of the protocol. As a result, the bits which might otherwise be interpreted as address, type, values for Nr, Ns, P/F and so forth are not recognizable to the protocol trace or to the Network Event Program. A condition from a frame with a bad FCS and one from a valid frame cannot become true together (from the same event). For instance, the following pair is never true together:

```
COND RCVD.BAD.FCS
     RCVD ADDR = #C2
```

You may view the address field of frames with bad checksums in the DA-30 Character Trace or Frame Detail. Use Examine Mode to locate the bad FCS frames within the Protocol Trace, and then switch to the Frame Detail or Character Trace to view the address field. A frame with a bad Frame Check Sequence may also be found in the Character Trace screen by using a Find Command within Examine Mode. However, a frame with a bad FCS may have been corrupted; bear in mind the possibility that the data reported in the Character Trace or Frame Detail screen may be inaccurate.

RCVD.INVALID

Syntax: RCVD.INVALID

Description: The RCVD.INVALID condition becomes true when a frame is received which has a good FCS, but is semantically impossible. No additional parameters can be used with this condition.

Type: External.

Example:

```
COND RCVD.INVALID
ACTN INC invalid.count
     ALARM
```

Remarks: Invalid frames cannot be interpreted by the protocol trace or by the Network Event Program. A condition from an invalid frame and one from a valid frame cannot become true together (from the same event). For instance, the following pair is never true together:

```
COND RCVD.INVALID
     RCVD ADDR = #C2
```

You may view the address field of invalid frame types in the DA-30 Frame Detail or Character Trace. Use Examine Mode to locate the invalid frames within the Protocol Trace, and then switch to the Character Trace or Frame Detail screen to view the address field.

RCVD.LONG

Syntax: RCVD.LONG

Description: The RCVD.LONG condition becomes true when a frame is received which is longer than the expected format for the SDLC frame type. For Supervisory format and most Unnumbered format frames (in Modulo 8), the maximum length is four Bytes. For the Unnumbered format, frame types UI, TEST, CFGR, XID and FRMR may include a one- or two-Byte Information field. For these types frame lengths of five or six Bytes are valid. Information format frames can include a variable number of 8-bit Information fields. No other parameters can be used with this condition.

Type: External.

Example:

```
COND RCVD.LONG
ACTN ENHANCE.FRAME
```

Remarks: Frames which are too long are invalid to protocol interpretation. Frame components such as address, the values of Nr, Ns and P/F and so forth are not recognizable by the protocol trace or by the Network Event Program. So, a condition from a long frame and one from a valid frame cannot become true together (from the same event). For instance, the following pair is never true together:

```
COND RCVD.LONG
     RCVD RR P/F = 1
```

You may view the address field of long frames in the DA-30 Character Trace. Use Examine Mode to locate the long frames within the Protocol Trace, and then switch to the Character Trace or Frame Detail screen to view the address field (and remaining frame elements).

RCVD.SHORT

Syntax: RCVD.SHORT

Description: The RCVD.SHORT condition becomes true when a frame is received which is shorter than the expected format for the SDLC frame type. All Modulo 8 SDLC frames must contain at least four Bytes to be valid. No other parameters can be used with this condition.

Type: External.

Example:

```
COND RCVD.SHORT
ACTN TRIG.LAYER 3 test.trig
     PROMPT.TRACE "Short frame received."
```

Remarks: A frame which is too short is not a valid frame, in accordance with the requirements of the protocol. As a result, the bits which might otherwise be interpreted as address, type, values for Nr, Ns, P/F and so forth are not recognizable to the protocol trace or to the Network Event Program. A condition from a short frame and one from a valid frame cannot become true together (from the same event). For instance, the following pair is never true together:

```
COND RCVD.SHORT
     RCVD NR = #03
```

You may view the address field of short frames in the DA-30 Character Trace or Frame Detail screen. Use Examine Mode to locate the short frames within the Protocol Trace, and then switch to the Character Trace to view the address field. Bear in mind that a too-short frame may have been corrupted, and the data could be inaccurate.

SDLC.3. Action Keywords

This section provides references for the Synchronous Data Link Control action keywords. The keywords are presented alphabetically, with a syntactical model, description and an example for each. The syntactical model explains what parameters are necessary or optional for use with the keyword. Additional remarks are included with some keywords to explain special conditions or exceptions.

Examples are shown to demonstrate the operation of the keyword. Actions fulfill the role of a THEN in an IF-THEN statement. The PAL statement ACTN x means "then execute x." Variable names and values shown in the examples are entirely arbitrary. They are used to suggest programming possibilities; they do not constitute a total program and they are not drawn from a real application.

ENHANCE.FRAME

Syntax: ENHANCE.FRAME

Description: The ENHANCE.FRAME action highlights a frame's representation in the Protocol Trace with reverse video attributes and identifies it for later use with the **find commands** feature in DA-30 Examine Mode. When a frame is enhanced in Run Mode it appears in reverse video in the Protocol Trace at the layer in which the ENHANCE.FRAME keyword is used. Further, the file created for Examine Mode operations can be searched for that frame by the criteria of ENHANCED.

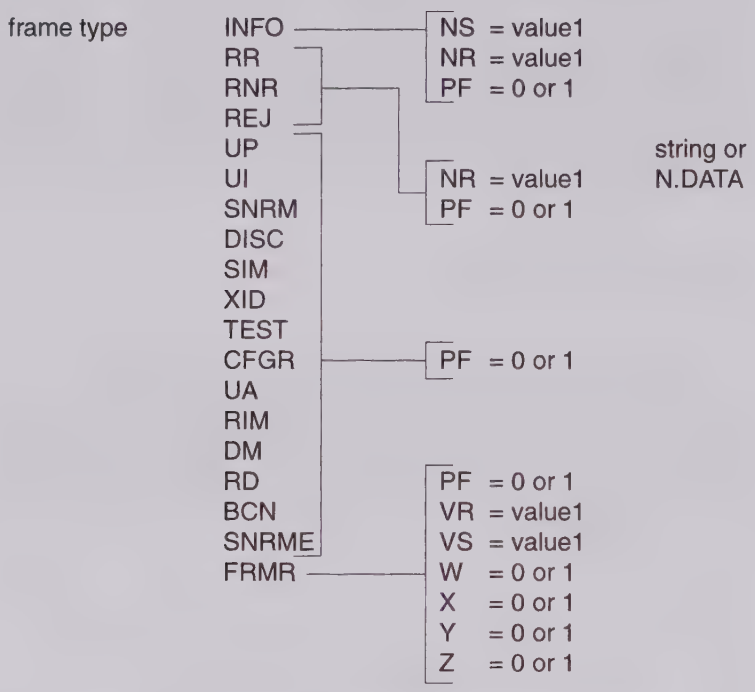
Example:

```
COND RCVD  RIM  PF = 1
ACTN ENHANCE.FRAME
```

Remarks: In order to execute an ENHANCE.FRAME action, the program must be processing a frame, not a key from the keyboard, or a timeout variable expiration, etc. Therefore, there are limits on the types of conditions that successfully execute the ENHANCE.FRAME action. Condition statements that deal with frames, or specific parameters of frames, such as the example given above, are valid. It is not possible to enhance a frame from an ANY.KEY condition or a timeout, trigger, etc.

SEND

Syntax: SEND ADDR = value PATH = value2



value an integer value between 0 and 255 (1 Byte Adress) or between 0 and 65535 (2 Byte Address), usually expressed in hexadecimal.

value1 an integer value between 0 and 7 (Modulo 8) or between 0 and 127 (Modulo 128).

value2 an integer value between 0 and 65535.

string a valid string, enclosed in " ".

Description: The SEND action transmits a frame with the referenced parameters from the SDLC program layer to program layer 1, from which it can be sent into the interface and out onto the network. The Path parameter allows Layer 1 to distinguish the source of the data. The address parameter specifies the address of the secondary station to be used in the frame.

Each SDLC frame type can be specified; these types are explained in the Trace Fields portion of the document section that accompanies the SDLC software. For SDLC Information format frames, a value may be specified for the Ns counter, the Nr counter and the Poll/Final bit. For Supervisory format frames (RR, RNR and REJ), a value may be specified for the Nr counter and the Poll/Final bit (0 or 1). For Unnumbered format frames, a value may be specified for the Poll/Final bit (0 or 1). For FRMR frames, the values of Nr and Ns, which are used in the Information field of the frame, can be specified as VR and VS parameters. You can also specify values for W, X, Y and Z (either 0 or 1). Values for the address, Ns and Nr can be specified either in decimal or hexadecimal. Use a preceding # symbol to identify hexadecimal numbers. For frame types INFO, UI, XID, TEST and CFGR, a string or N.DATA primitive (the layer 3 Protocol Data Unit) may be specified as additional data. Parameters may be specified singly or in combinations.

SEND (cont.)

Example:

```
COND DATA.FROM.UP
ACTN SEND ADDR = #C3 INFO N.DATA

COND KEY "1"
ACTN SEND FRMR  P/F = 1  W = 0
     PROMPT "Sending FRMR frame with final bit set."
```

Remarks: To run an application using the SDLC SEND keyword in a PAL program, the Test Mode field in the DA-30's Line Setup Window for the interface Slot must specify Emulate. In order to send data of type N.DATA, the program must be processing this type of data, not a key from the keyboard, or a trigger, etc. Condition statements that deal with this type of data, such as the example given above, are valid. It is not possible to send N.DATA from an ANY.KEY condition or a timeout, trigger, etc.

SUPPRESS.FRAME

Syntax: SUPPRESS.FRAME

Description: The SUPPRESS.FRAME action causes a frame to be suppressed from the Character and Protocol Trace displays, from capture and logging, and from use in the Network Event Program. This capability is similar to the Layer Filter functions, but allows selective suppression of frames based on core or protocol-specific criteria.

Example:

```
COND RCVD ADDR = #C5
ACTN SUPPRESS.FRAME
```

Remarks: In order to execute a SUPPRESS.FRAME action, the program must be processing a frame, not a key from the keyboard, or a timeout variable expiration, etc. Therefore, there are limits on the types of conditions that successfully execute the SUPPRESS.FRAME action. Condition statements that deal with frames, or specific parameters of frames, such as the example given above, are valid. It is not possible to suppress a frame from an ANY.KEY condition or a timeout, trigger, etc.

SDLC.4. PAL BNF Definitions

The following BNF (Backus-Naur Form) definitions for SDLC keywords may prove handy as a programming quick reference.

sdlc.pal.statement	::=	sdlc.condition | sdlc.action
sdlc.condition	::=	RCVD [rcvd.modifier] | RCVD.SHORT | RCVD.INVALID | RCVD.LONG | RCVD.BAD.FCS
rcvd.modifier	::=	{[ADDR=integer][frame.detail]} any
frame.detail	::=	INFO [info.type] | supervisory [supervisory.type] | unnumbered [P/F=integer] | FRMR [frmr.type]
info.type	::=	{[NR=integer][NS=integer][P/F=integer]} any
supervisory	::=	RR | RNR | REJ
supervisory.type	::=	{[NR=integer][P/F=integer]} any
unnumbered	::=	UP | UI | SNRM | DISC | SIM | XID | TEST | CFGR | UA | RIM | DM | RD | BCN | SNRME
frmr.type	::=	{ [P/F=integer][VR=integer][VS=integer][W=integer][X=integer] [Y=integer][Z=integer] } any
sdlc.action	::=	SEND [PATH = integer] send.modifier | ENHANCE.FRAME | SUPPRESS.FRAME
send.modifier	::=	{ [ADDR=integer] send.type} any
send.type	::=	INFO send.info.type | supervisory [send.supervisory.type] | unnumbered.data [unnumbered.data.type] | unnumbered.non.data [P/F=integer] | FRMR frmr.type
send.info.type	::=	{ [NR=integer][NS=integer][P/F=integer][string | N.DATA] } any
send.supervisory.type	::=	{ [NR=integer][P/F=integer] } any
unnumbered.data	::=	UI | XID | TEST | CFGR
unnumbered.data.type	::=	{ [P/F=integer][string | N.DATA] } any
unnumbered.non.data	::=	UP | SNRM | DISC | SIM | UA | RIM | DM | RD | BCN | SNRME

Notes:

1) The term “any” implies that items between “{” and “}” can appear in any order.

2) For definitions of “string” and “integer” refer to BNF definition for core PAL keywords.

Second Edition October 1993 Release 3.4 and after

Frame Relay

Frame Relay Operation

FR.1. Introduction

This document describes the protocol-specific operation of the DA-3x with Version 1.1 of the Frame Relay Layer Protocol Package. Any changes affecting this operating information will be addressed in Release Notes.

Information on installing an LPP on the DA-3x, loading a protocol on the protocol stack, monitoring and examining network traffic, searching for specific frames, and filtering captured traffic is provided in the preface to this manual.

FR.1.1. Introduction to the Frame Relay Protocol

Frame Relay defines an interface between Customer Premise Equipment (CPE) such as a LAN bridge, router or a front-end processor, and a network to provide high performance LAN interconnection across a WAN. Frame Relay takes advantage of the increased intelligence of the devices attached to the network and the availability of error-free, high-speed transmission lines to provide fast, efficient, connection-oriented service.

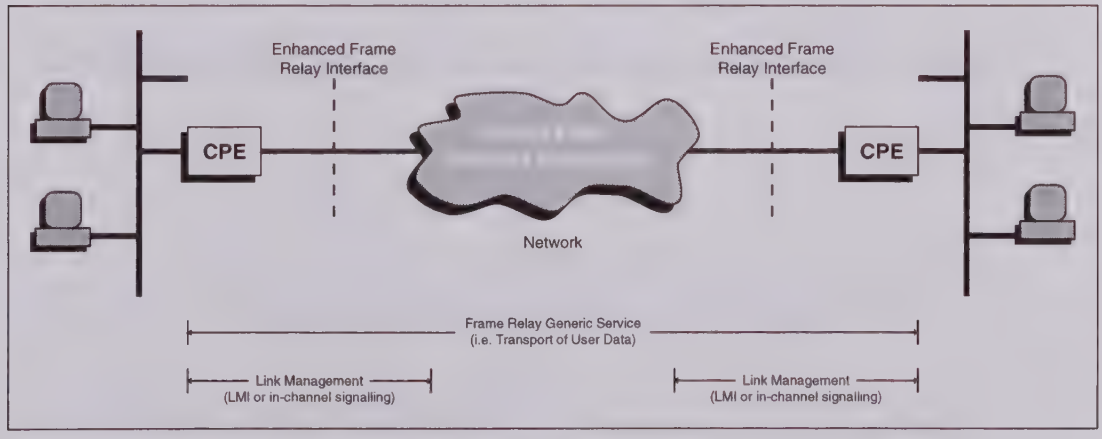

Enhanced Frame Relay Interface
Enhanced Frame Relay Interface
CPE
CPE
Network
Frame Relay Generic Service (i.e. Transport of User Data)
Link Management (LMI or in-channel signalling)
Link Management (LMI or in-channel signalling)

Figure FR-1 Frame Relay interface definition

Frame Relay is a frame-based protocol that uses permanent virtual circuits (PVCs) to carry data from one end user location to another. The virtual circuit uniquely defines the path

between two endpoints. Frame Relay provides multiple logical connections over a single physical circuit and allows the network to route data over those connections to its intended destinations. Frames are received over a frame relay interface and forwarded hop-by-hop from the source node to the destination node.

The minimal amount of processing that Frame Relay does contributes to its high throughput. It handles basic Data Link and Network Layer functions such as providing access to a network, delimiting and delivering frames in proper order, routing and multiplexing, and leaves other functions such as error handling, acknowledgement and retransmission, and sequence numbering to higher layers. The higher layers are responsible for error-free end-to-end transmission of data. The only error checking that is performed by the network is CRC checking. Frames that contain a bad CRC are discarded.

An important principle in Frame Relay is that if there is a problem in handling a frame, the frame is discarded. Frame Relay discards frames without notification and relies on higher layers for recovery. Errored data and congestion are the two main reasons frames are discarded. Bit errors are minimized with clean transmission lines, which are a requirement for Frame Relay. A Discard Eligibility (DE) bit and Forward and Backward Explicit Congestion Notification bits (FECN and BECN) are used to minimize congestion. The DE bit indicates that a frame may be discarded if congestion occurs. The FECN and BECN bits warn other nodes on the network of congestion. Compliance with congestion reducing requests is optional, and if the requests are ignored, the network may discard any excess frames.

The basic Frame Relay protocol delivers data quickly and efficiently. An interface signalling mechanism improves network performance and helps avoid problems by allowing a subscriber and the network to exchange information about the link itself and the status of other PVCs. Two types of link management protocols are available: In-channel signalling and Local Management Interface (LMI). Both protocols run in a dedicated PVC of a Frame Relay link and manage the interface.

For more information about Frame Relay refer to the documents listed below.

Frame Relay Specification with Extensions, based on proposed T1S1 standard - a joint document by Digital Equipment Corporation, Northern Telecom, Inc., StrataCom Inc., and cisco, Inc., 1990.

American National Standard T1.617, Annex D, 1991.

CCITT Q.933, Annex A, 1991.

The Buyer's Guide to Frame Relay Networking, Second Edition, Netrix Systems Corporation, 1991.

FR.1.2. Loading Frame Relay in the Protocol Stack

Frame Relay is loaded at Layer 1 of the protocol stack. A WAN Line Interface module must be installed in one of the mainframe slots 4 - 7, but you do not have to load the Line Interface Package in the protocol stack to use the Frame Relay LPP. You can load the Frame Relay LPP at a layer other than Layer 1 using the custom stack softkey (F2). This softkey lets you choose the layer at which to load a protocol, with the restriction that it must appear in the stack in the correct order from lowest to highest layer relative to other protocols. If you load a higher layer protocol beneath a lower layer protocol (for example, a Layer 4 protocol beneath a Layer 3 protocol), the instrument does not decode the higher layer protocol.

FR.1.3. Completing the Frame Relay Configuration Setup Menu

A Frame Relay configuration menu is available in the protocol stack screen that allows you to further filter traffic and customize DA-3x operation with regard to this protocol. Press the config menu softkey (F4) when the cursor is highlighting Frame Relay in the protocol stack to access the Frame Relay configuration menu. Figure FR-2 shows the Configuration Menu Screen for the Frame Relay protocol.

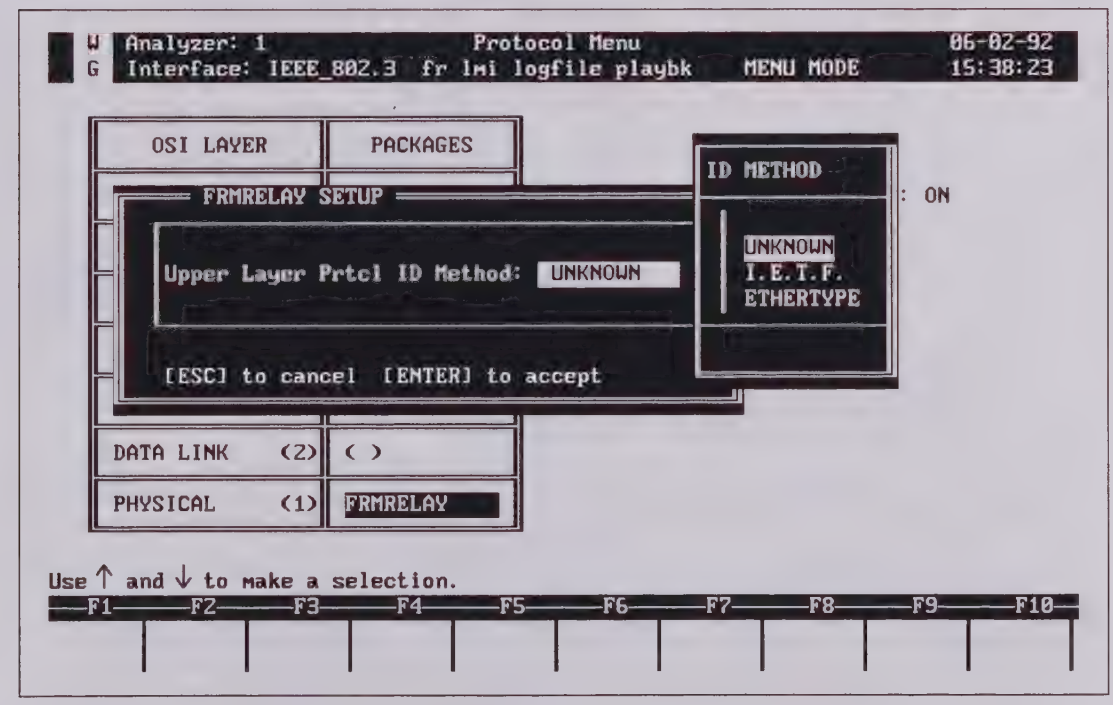

W Analyzer: 1 Protocol Menu 06-02-92
G Interface: IEEE_802.3 fr lmi logfile playbk MENU MODE 15:38:23
OSI LAYER
PACKAGES
FRMRELAY SETUP
Upper Layer Prtcl ID Method: UNKNOWN
[ESC] to cancel [ENTER] to accept
ID METHOD
UNKNOWN
I.E.T.F.
ETHERTYPE
: ON
DATA LINK (2) ( )
PHYSICAL (1) FRMRELAY
Use ↑ and ↓ to make a selection.
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10

Figure FR-2 The Frame Relay configuration menu

The Frame Relay configuration setup allows you to specify the way in which the DA-3x decodes upper layer protocols. Your choice should be consistent with the setup of the network. Press F1 (view options) to select one of the following ID Methods:

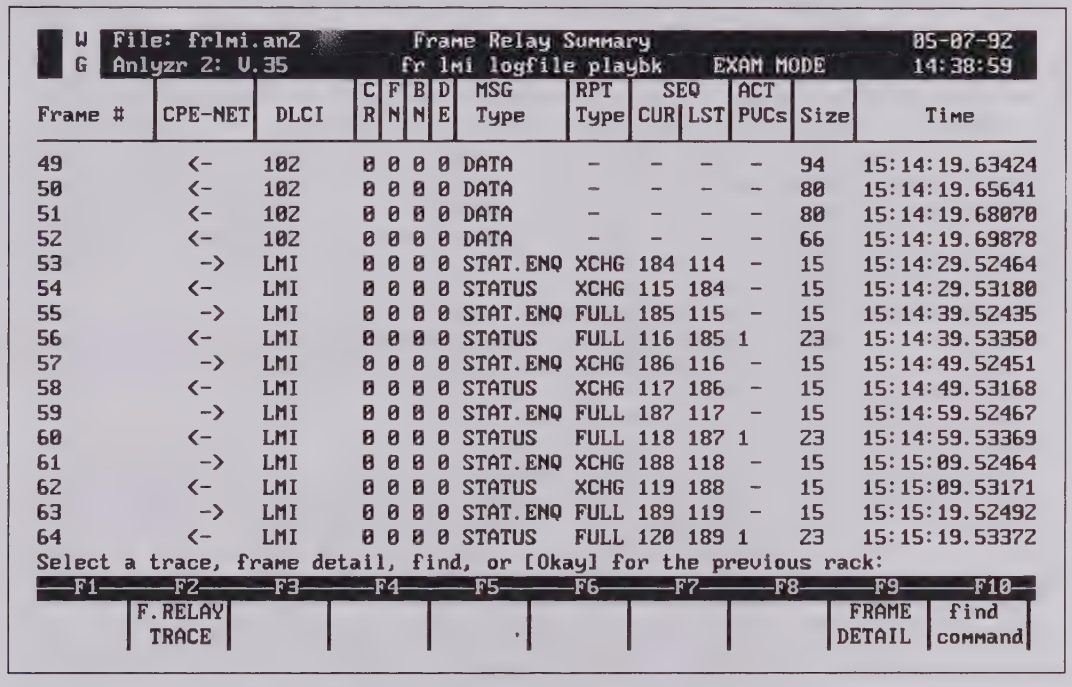
- Unknown
- I.E.T.F. (Internet Engineering Task Force)
- Ethertype

When you select Unknown, the DA-3x does not decode anything above Frame Relay in the protocol stack because it is unable to identify the higher layer protocol. The IETF method can identify bridging and routing protocols. This method uses the Network Level Protocol ID

(NLPID) and Subnetwork Access Protocol (SNAP) to tell the receiver how to interpret the contents of the frame. The third option, Ethertype, uses the two-octet Ethernet Packet Type for identification of upper layer protocols.

FR.2. Trace Fields

A sample Frame Relay Summary Trace screen is shown in Figure FR-3. An explanation of the trace fields follows.



W File: frlmi.an2 Frame Relay Summary 05-07-92
G Anlyzr 2: V.35 fr lmi logfile playbk EXAM MODE 14:38:59

Frame #	CPE-NET	DLCI	C R	F N	B N	D E	MSG Type	RPT Type	SEQ CUR	SEQ LST	ACT PVCs	Size	Time
49	<-	102	0	0	0	0	DATA	-	-	-	-	94	15:14:19.63424
50	<-	102	0	0	0	0	DATA	-	-	-	-	80	15:14:19.65641
51	<-	102	0	0	0	0	DATA	-	-	-	-	80	15:14:19.68070
52	<-	102	0	0	0	0	DATA	-	-	-	-	66	15:14:19.69878
53	->	LMI	0	0	0	0	STAT.ENQ	XCHG	184	114	-	15	15:14:29.52464
54	<-	LMI	0	0	0	0	STATUS	XCHG	115	184	-	15	15:14:29.53180
55	->	LMI	0	0	0	0	STAT.ENQ	FULL	185	115	-	15	15:14:39.52435
56	<-	LMI	0	0	0	0	STATUS	FULL	116	185	1	23	15:14:39.53350
57	->	LMI	0	0	0	0	STAT.ENQ	XCHG	186	116	-	15	15:14:49.52451
58	<-	LMI	0	0	0	0	STATUS	XCHG	117	186	-	15	15:14:49.53168
59	->	LMI	0	0	0	0	STAT.ENQ	FULL	187	117	-	15	15:14:59.52467
60	<-	LMI	0	0	0	0	STATUS	FULL	118	187	1	23	15:14:59.53369
61	->	LMI	0	0	0	0	STAT.ENQ	XCHG	188	118	-	15	15:15:09.52464
62	<-	LMI	0	0	0	0	STATUS	XCHG	119	188	-	15	15:15:09.53171
63	->	LMI	0	0	0	0	STAT.ENQ	FULL	189	119	-	15	15:15:19.52492
64	<-	LMI	0	0	0	0	STATUS	FULL	120	189	1	23	15:15:19.53372

Select a trace, frame detail, find, or [Okay] for the previous rack:

F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
F.RELAY TRACE | FRAME DETAIL | find command

Figure FR-3 Frame Relay Summary Trace screen

Frame # Frame number is the reference number of the frame. The instrument assigns frame numbers in the order it receives frames, beginning with 1.

CPE-NET The CPE - NET field indicates the direction of the frame. An arrow pointing to the right (→) represents frames sent from the CPE (Customer Premise Equipment) to the NET (network); an arrow pointing to the left (←) represents frames coming from the network to the CPE.

DLCI The Data Link Connection Identifier (DLCI) identifies a permanent virtual connection. Valid DLCIs range from 0 - 1023 for two-octet addresses. The following DLCIs are allocated for specific purposes:

Two-octet address format

DLCI	Use
0	In-channel signalling
1-15	Reserved
1008-1018	Reserved
1019-1022	Multicast groups
1023	Local Management Interface (LMI)

When the Data Link Connection Identifier (DLCI) field equals 1023, the Summary Trace displays "LMI". For non-LMI frames the DLCI's decimal value is displayed.

The DLCI reserved for the LMI depends on the length of the address. When 3- or 4-octet extended addresses are used, DLCI 1023 is unavailable for the LMI. The DLCI values for extended address formats are shown below.

Three-octet address format

DLCI	Use
0	In-channel signalling
1 - 1023	Reserved
1024 - 64,511	Frame Relay Connections
64,512 - 65,534	Reserved
65,535	Local Management Interface (LMI)

Four-octet address format

DLCI	Use
0	In-channel signalling
1 - 131,071	Reserved
131,072 - 8,257,535	Frame Relay Connections
8,257,536 - 8,388,606	Reserved
8,388,607	Local Management Interface (LMI)

CR, FN, BN, DE These fields display the status of the following four bits: the Command/Response field bit, the Forward Explicit Congestion Notification (FECN) bit, the Backward Explicit Congestion Notification (BECN) bit, and the Discard Eligibility (DE) bit.

The Command/Response bit is not used by the Frame Relay protocol and may be defined by implementors.

The FECN and BECN bits notify a user device of congestion on the network, either in the direction of the frame's path across the network (FECN) or in the opposite direction (BECN), and ask the device to withhold traffic or reduce its transmission rate until the congestion has cleared. Complying with a request to reduce or withhold traffic is optional.

When a Frame Relay network gets congested it discards frames. In the event of congestion the network discards frames with the DE bit set to 1 before those in which DE is set to 0.

Msg Type The message type field indicates the type of Frame Relay frame that was sent. Possible message types are shown below.

Mnemonic	Message Type
STAT.ENQ	Status Enquiry frame
STAT.UPD	Status Update frame
STATUS	Status frame
DATA	Data frame
XID	Exchange ID frame

RPT Type

Report Type information elements are required in Status and Status Enquiry messages. In LMI frames, two reports types are used: Full Status Message (FULL) and Sequence Number Exchange (XCHG). Full Status report types contain a PVC Status information element for each DLCI currently defined for the link. Sequence Number Exchange report types contain the current and last sequence numbers from the Keep Alive information element. The Report Type information element is not used in Data or Status Update messages.

In-channel signalling frames make use of three report type information elements. The Full Status Message (FULL) and Link Integrity Verification (LNKV) perform the same functions as the Full Status and Keep Alive LMI information elements. The third Report Type, PVC Asynchronous Status (PVCA), contains a single PVC Status information element.

SEQ CUR/LST

The sequence field displays the two sequence numbers from the LMI Keep Alive Sequence information element: the current sequence number and the last received sequence number. For an in-channel signalling Link Verification information element, the send and receive sequence numbers are displayed. The Keep Alive Sequence/Link Integrity Verification IE is used in Status and Status Enquiry messages.

ACT PVCs

The active PVCs field indicates the total number of active permanent virtual circuits on the network. This is the number of active DLCIs set in the PVC Status information elements of the Status or Status Update messages.

Size

The size field displays the length of the Frame Relay frame in octets, excluding the opening and closing flags. A frame must contain at least one octet of user data, for a total of 5 octets between flags. The maximum allowable size of a Frame Relay frame is 8192 octets between flags, counting header and FCS, although standards recommend a maximum frame size of 1600 octets.

Time

Time indicates the timestamp of the DA-3x. The instrument displays the time that it captured the frame.

FR.3. Frame Detail

The Frame Relay Frame Detail decodes the fields of the Frame Relay header. The format of the Frame Relay header is shown in Figure FR-4.

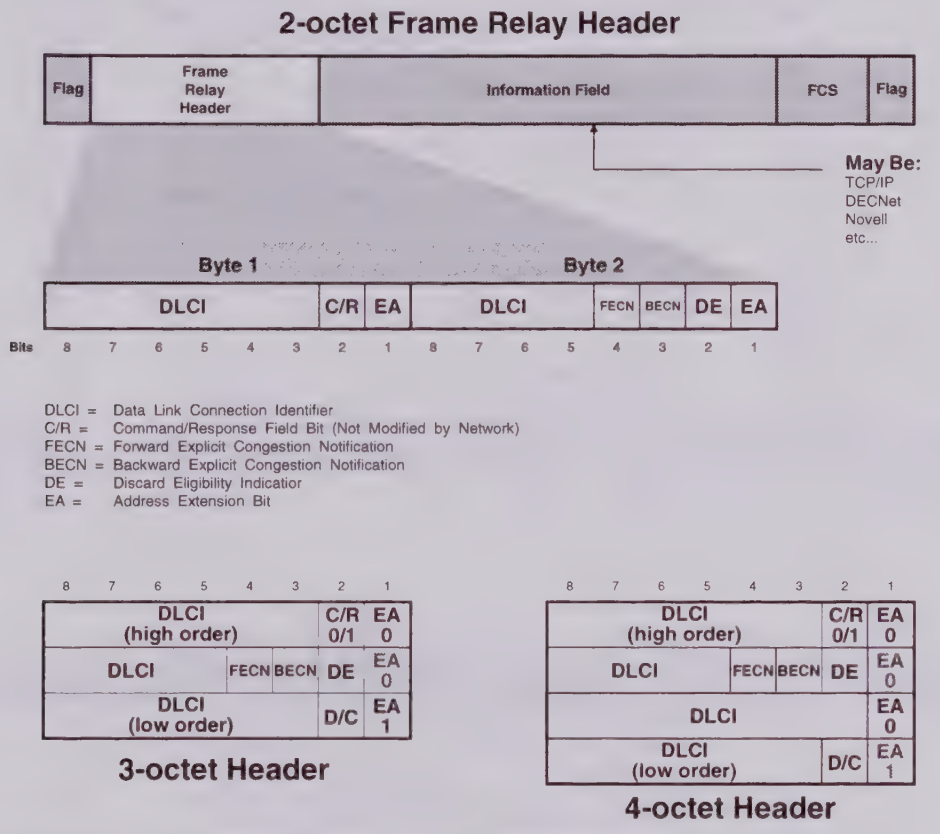


Figure FR-4 Frame Relay header — 2-, 3-, and 4-octet formats

Frame Detail provides a detailed analysis of the frame highlighted on the Summary Trace screen. The Frame Relay Frame Detail screen shows the hexadecimal and binary decodes of the Frame Relay frame and its associated description (decimal values are noted by a lowercase "d" next to the value). To access the Frame Detail screen, press F9 (FRAME DETAIL) from the Summary Trace screen. You must be in Examine Mode to view the Frame Detail display.

A sample Frame Relay Frame Detail screen is shown in Figure FR-5. The Frame Detail screen shows the Frame Relay header, the Link Management header, and several information elements. Each of these parts of the Frame Relay frame are described in the sections below, followed by a discussion of the XID message.

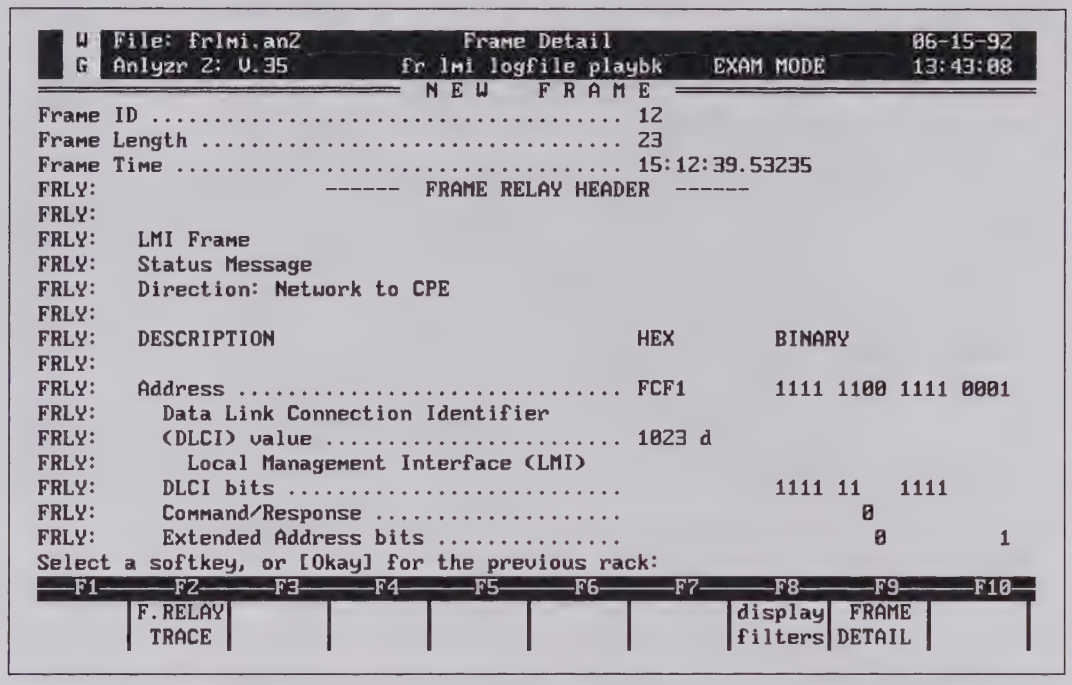

W File: frlmi.an2 Frame Detail 06-15-92
G Anlyzr 2: V.35 fr lmi logfile playbk EXAM MODE 13:43:08
NEW FRAME
Frame ID 12
Frame Length 23
Frame Time 15:12:39.53235
FRLY: ------ FRAME RELAY HEADER ------
FRLY:
FRLY: LMI Frame
FRLY: Status Message
FRLY: Direction: Network to CPE
FRLY:
FRLY: DESCRIPTION HEX BINARY
FRLY:
FRLY: Address FCF1 1111 1100 1111 0001
FRLY: Data Link Connection Identifier
FRLY: (DLCI) value ..... 1023 d
FRLY: Local Management Interface (LMI)
FRLY: DLCI bits 1111 11 1111
FRLY: Command/Response 0
FRLY: Extended Address bits 0 1
Select a softkey, or [Okay] for the previous rack:
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
F.RELAY TRACE
display filters
FRAME DETAIL

Figure FR-5 Screen 1 of 4

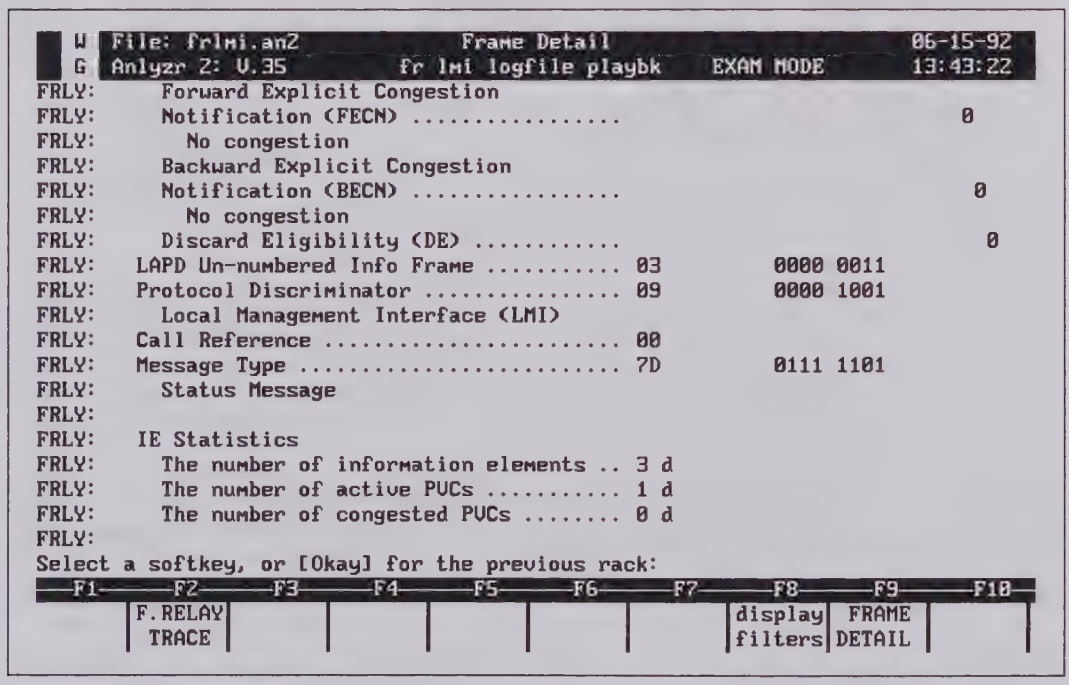

W File: frlmi.an2 Frame Detail 06-15-92
G Anlyzr 2: V.35 fr lmi logfile playbk EXAM MODE 13:43:22
FRLY: Forward Explicit Congestion
FRLY: Notification (FECN) 0
FRLY: No congestion
FRLY: Backward Explicit Congestion
FRLY: Notification (BECN) 0
FRLY: No congestion
FRLY: Discard Eligibility (DE) 0
FRLY: LAPD Un-numbered Info Frame 03 0000 0011
FRLY: Protocol Discriminator 09 0000 1001
FRLY: Local Management Interface (LMI)
FRLY: Call Reference 00
FRLY: Message Type 7D 0111 1101
FRLY: Status Message
FRLY:
FRLY: IE Statistics
FRLY: The number of information elements .. 3 d
FRLY: The number of active PVCs ..... 1 d
FRLY: The number of congested PVCs ..... 0 d
FRLY:
Select a softkey, or [Okay] for the previous rack:
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
F.RELAY TRACE
display filters
FRAME DETAIL

Figure FR-5 Screen 2 of 4

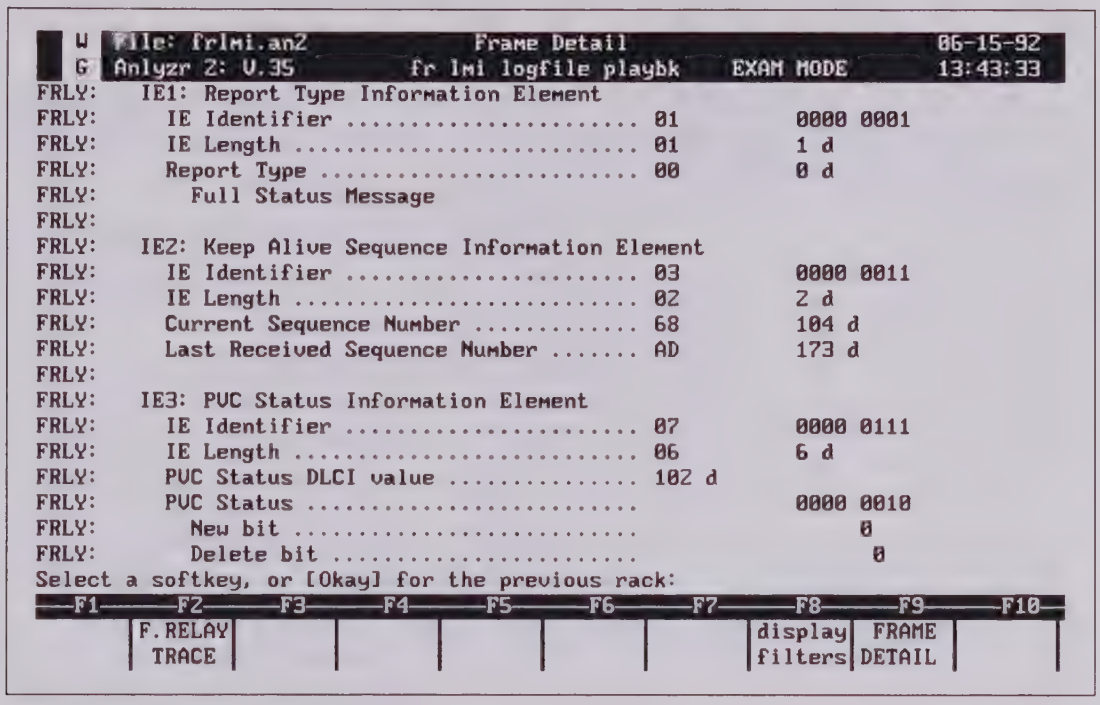

W File: frlmi.an2 Frame Detail 06-15-92
G Anlyzr 2: V.35 fr lmi logfile playbk EXAM MODE 13:43:33
FRLY: IE1: Report Type Information Element
FRLY: IE Identifier 01 0000 0001
FRLY: IE Length ..... 01 1 d
FRLY: Report Type ..... 00 0 d
FRLY: Full Status Message
FRLY:
FRLY: IE2: Keep Alive Sequence Information Element
FRLY: IE Identifier 03 0000 0011
FRLY: IE Length ..... 02 2 d
FRLY: Current Sequence Number ..... 68 104 d
FRLY: Last Received Sequence Number ..... AD 173 d
FRLY:
FRLY: IE3: PVC Status Information Element
FRLY: IE Identifier 07 0000 0111
FRLY: IE Length ..... 06 6 d
FRLY: PVC Status DLCI value ..... 102 d
FRLY: PVC Status 0000 0010
FRLY: New bit 0
FRLY: Delete bit 0
Select a softkey, or [Okay] for the previous rack:
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
F.RELAY TRACE
display filters
FRAME DETAIL

Figure FR-5 Screen 3 of 4

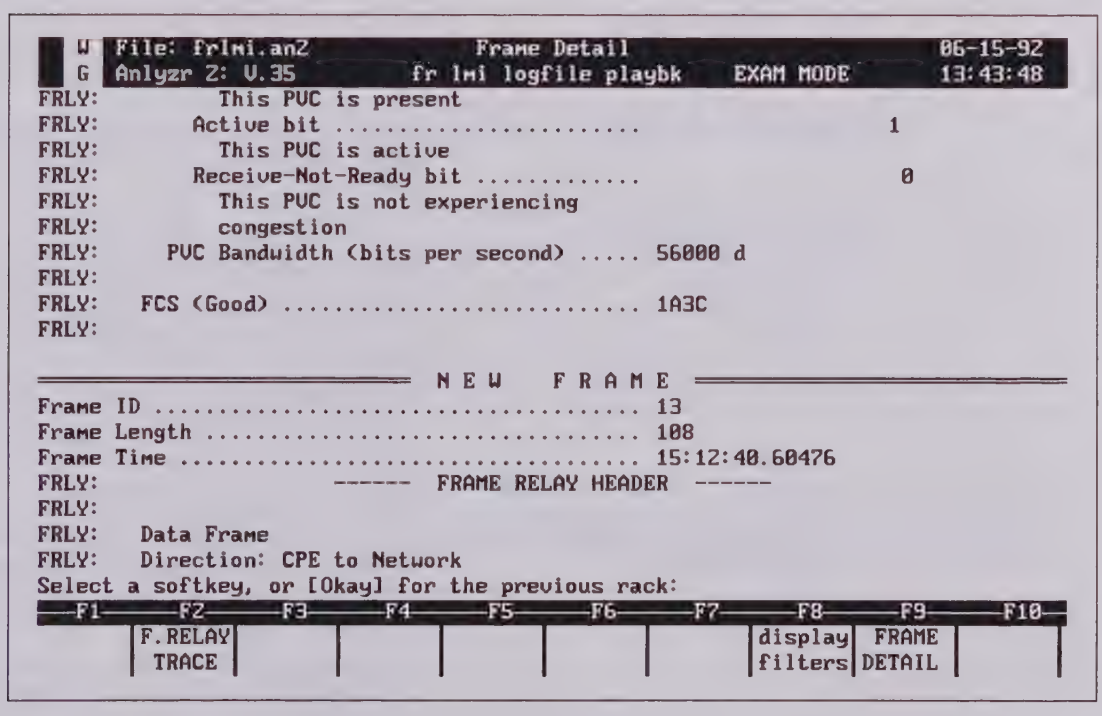

W File: frlmi.an2 Frame Detail 06-15-92
G Anlyzr 2: V.35 fr lmi logfile playbk EXAM MODE 13:43:48
FRLY: This PVC is present
FRLY: Active bit 1
FRLY: This PVC is active
FRLY: Receive-Not-Ready bit 0
FRLY: This PVC is not experiencing
FRLY: congestion
FRLY: PVC Bandwidth (bits per second) ..... 56000 d
FRLY:
FRLY: FCS (Good) 1A3C
FRLY:
NEW FRAME
Frame ID 13
Frame Length 108
Frame Time 15:12:40.60476
FRLY: ------ FRAME RELAY HEADER ------
FRLY:
FRLY: Data Frame
FRLY: Direction: CPE to Network
Select a softkey, or [Okay] for the previous rack:
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
F.RELAY TRACE
display filters
FRAME DETAIL

Figure FR-5 Screen 4 of 4
Frame Relay Frame Detail (Full Status LMI frame)

FR.3.1. Frame Relay Header

This section describes the fields of the Frame Relay header.

Frame Type, Message Type, and Direction

Four types of frames are supported:

- data frames
- Local Management Interface (LMI) frames
- In-channel signalling frames
- Exchange ID (XID) frames

The Frame Relay LPP supports CCITT Q.933 Annex A and ANSI T1.617 Annex D in-channel signalling. The standard is noted next to the description of the frame type.

The message type and its direction (CPE to network or network to CPE) are noted at the top of the Frame Description. The message type is one of the following: Data, Status, Status Update, Status Enquiry, XID.

Address

The typical Frame Relay address is 2 octets. These two address octets are decoded at the beginning of the Frame Detail. The address fields are described below. Extended address octets are discussed later in this section.

Data Link Connection Identifier (DLCI)

A DLCI identifies a permanent virtual connection. The decimal value of the DLCI is displayed as well as the ten bits that make up the DLCI.

Command/Response

The Command/Response bit is not used by the Frame Relay data link protocol and may be defined by implementors.

Extended Address bits

When the Extended Address bit (EA) is zero, the frame's address (DLCI) continues in the next octet. Because a DLCI occupies a minimum of two octets (6 bits of the 10-bit address in the second octet and 4 more in the third octet), the EA bit is always zero in the second octet. When an EA bit is set to 1, it indicates the end of the address information. In a normal frame relay frame, the EA bit in the third octet is 1. An EA value of 0 indicates that an Extended Address octet follows.

Forward Explicit Congestion Notification (FECN)

The FECN bit, when set, notifies downstream nodes (those toward the destination) of congestion on that DLCI. The congested node changes the FECN bit from 0 to 1 when it senses congestion. Congestion is typically detected by determining memory use or queue length. When the FECN bit is 0, there is no congestion toward the destination.

Backward Explicit Congestion Notification (BECN)

The BECN bit, when set, notifies the source of the traffic that the path toward the frame's source is congested. This enables the source to slow down transmission until the congestion subsides. When the BECN bit is 0, there is no congestion toward the destination.

Discard Eligibility (DE)

When the Discard Eligibility bit is set, the frame is discarded in preference to other frames when the network

	is congested. Both user devices and the network are able to set the DE bit.
Last octets in Address	Last octets in the Address apply to 3- and 4-octet extended addresses. When an extended address is used, the DLCI bits for octets 3 and 4 are displayed, along with the Extended Address bits and DLCI/Control Information bits. The Control bit is limited to use in the last octet of the three- or four-octet address field. This bit indicates whether the remaining 6 bits of the last octet are to be interpreted as the lower DLCI bits, and therefore part of the address, or as control bits. When the Control bit is 0, the octet contains DLCI information. When the Control bit is set to 1, the octet contains control information, which is currently undefined.
Frame Check Sequence (all frame types)	The Frame Check Sequence is calculated (Cyclical Redundancy Check) for all message types. The CRC checks the integrity of the frame and is either good or bad. The value is displayed in hexadecimal. If the FCS indicates an error the frame is discarded.

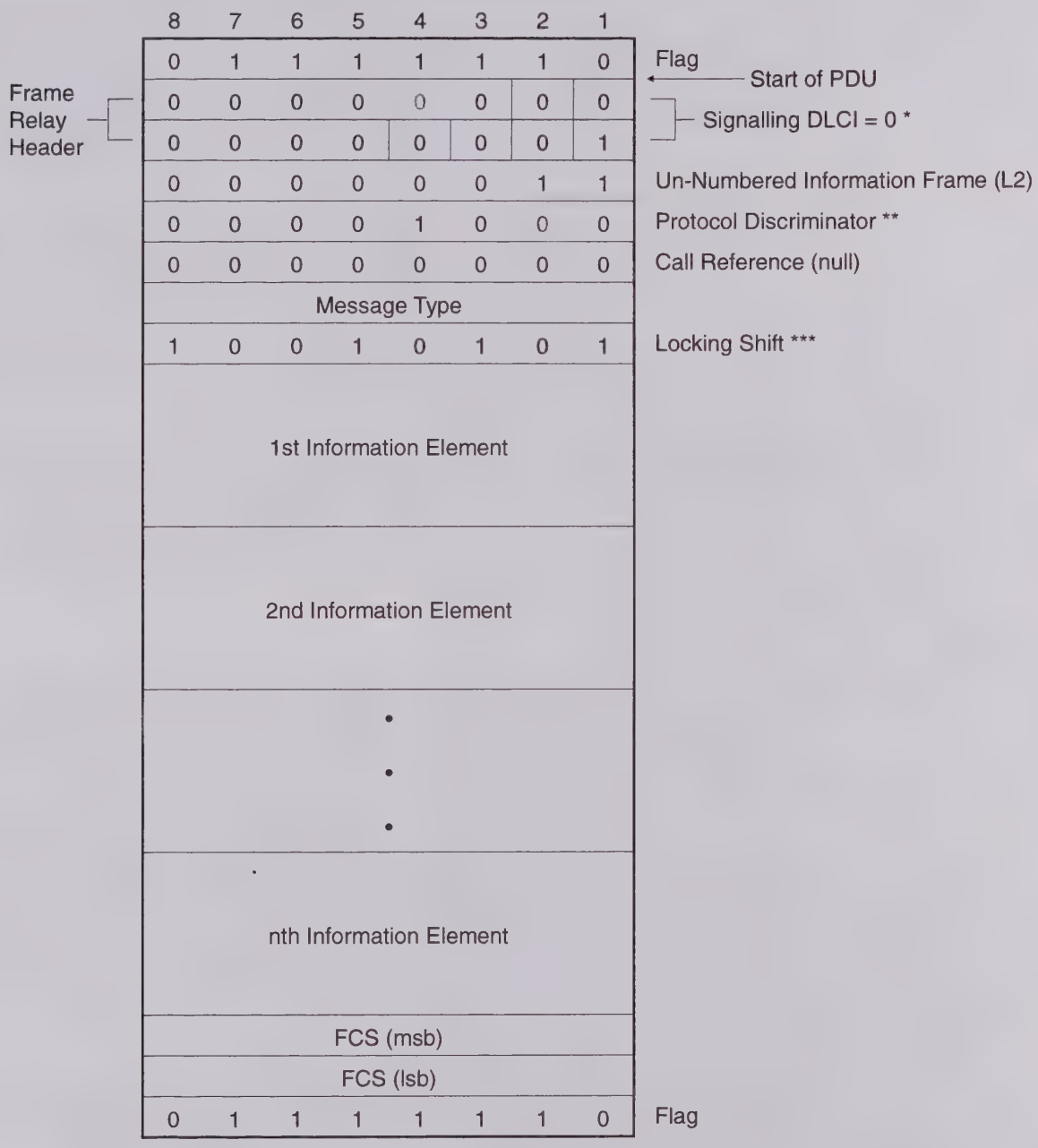
FR.3.2. Link Management Header

Several DLCIs are reserved for link management. These DLCIs carry information about the status of PVCs between the network and a user interface. DLCI 0 is known as in-channel signalling. The Local Management Interface (LMI) uses DLCI 1023 for 2-octet addresses, DLCI 65,535 for 3-octet addresses, and DLCI 8,388,607 for 4-octet addresses.

There are three types of LMI messages: Status Enquiry, Status, and Status Update. The subscriber initiates an LMI exchange by sending a Status Enquiry message; the network completes the exchange by responding with a Status message. These exchanges verify that a link is running normally or report on the individual status of each DLCI defined for the link. Bidirectional Status and Status Enquiry messages are optional on DLCI 0 (in-channel signalling). A Status Update message is unsolicited. It allows the network to communicate changes in a PVC's status without first receiving a Status Enquiry from the subscriber. It contains Status information for only for those PVCs and multicast groups whose status has changed.

In link management frames the Frame Relay user data field consists of an LMI or in-channel signalling header and several information element fields. Both header formats are shown in Figure FR-6. A description of the header fields follows. Information elements are discussed in the next section of this document.

Annex D Frame Format (in-channel signalling)


8 7 6 5 4 3 2 1
0 1 1 1 1 1 1 0
Flag
Start of PDU
Frame Relay Header
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 1
Signalling DLCI = 0 *
0 0 0 0 0 0 1 1
Un-Numbered Information Frame (L2)
0 0 0 0 1 0 0 0
Protocol Discriminator **
0 0 0 0 0 0 0 0
Call Reference (null)
Message Type
1 0 0 1 0 1 0 1
Locking Shift ***
1st Information Element
2nd Information Element
nth Information Element
FCS (msb)
FCS (lsb)
0 1 1 1 1 1 1 0
Flag

* LMI DLCI = 1023
** LMI Protocol Discriminator = 9
*** No Locking Shift in LMI and Annex A

Figure FR-6 Link management headers

Unnumbered Information Frame The Data Link protocol used for link management is a subset of LAPD, a protocol that defines a six octet header. The first two octets contain the link management DLCI (0, 1023, etc.). The third octet of the header is always a LAPD Unnumbered Information frame with a decimal value of 3, in accordance with the LAPD standard.

Protocol Discriminator For LMI frames, the Protocol Discriminator is always set to 09 (decimal). For in-channel signalling frames the Protocol Discriminator is set to 08 (decimal), indicating a User-network Call Control Message.

Call Reference (Null) The Call Reference field is a LAPD parameter that is always set to zero in a link management frame.

Message Type The link management header identifies the message type as either a Status Message, Status Enquiry or Status Update.

Locking Shift The locking shift field is found in ANSI in-channel signalling frames. It is always set to 95 (hexadecimal), which is ANSI codeset 5. This field is not included in the CCITT Q.933 Annex A and LMI standards.

FR.3.2.1. Information Elements

Information elements (IEs) are the smallest unit of status information that can be exchanged in a link management message. This section discusses each of the following information elements individually: Report Type IE, Keep Alive Sequence/Link Integrity Verification IE, PVC Status IE, and Multicast Status IE.

All link management messages, with the exception of the Asynchronous PVC Status message, contain one Report Type and one Keep-Alive/Link Verification information element. A full Status message from the network to the subscriber also contains one PVC Status element for each PVC on the link. The information elements associated with each message type are shown in Tables FR-1 and FR-2, and described in the following sections.

LMI Information Elements

Message Type	Direction NET	Direction CPE	Report Type	Keep Alive Sequence	PVC Status	Multicast Status
STATUS	→		Required	Required	Optional	Optional
STATUS ENQUIRY	←		Required	Required	----------	----------
STATUS UPDATE	→		----------	----------	Optional	Optional

Table FR-1 Required and optional information elements for LMI message types.

In-channel signalling Information Elements

Message Type	Direction NET	Direction CPE	Report Type	Link Integrity Verification	PVC Status
STATUS	↔		Required	Required	Optional
STATUS ENQUIRY	↔		Required	Required	----------

Table FR-2 Required and optional information elements for in-channel signalling message types. Bidirectional implementation is optional.

IE Statistics The IE Statistics provide summary information about the message. This information is provided by the DA-3x; it is not a field in the link management header. The information element summary information includes the following statistics:

- the number of information elements
- the number of active PVCs (for Status and Status Update messages)
- the number of congested PVCs (for LMI Status and Status Update messages)

FR.3.2.1.1. Report Type IE

The Report Type information element indicates whether the message is a Full Status message, a Sequence Number Exchange/Link Integrity Verification, or a PVC Asynchronous Status message. Full Status messages contain statistics for each DLCI defined on the link while Sequence Number Exchange Only/Link Integrity messages contain link verification information. PVC Asynchronous Status messages contain statistics for a single PVC. The Report Type indicates the type of message; details of the message (statistics or link verification information) are contained in other Information Elements.

8	7	6	5	4	3	2	1
0	0	0	0	0	0	0	1
1 (decimal)							
Report Type							

Figure FR-7 Report Type Information Element format

IE Identifier The Report Type IE has an IE identifier of 01 hexadecimal for LMI and Annex D frames, and 51 hexadecimal for Annex A.

IE Length The IE Length of the Report Type is 1 octet.

Report Type This field identifies the Report Type as either a Full Status Message, a Sequence Number Exchange Only (LMI)/Link Integrity Verification, or a PVC Asynchronous Status message. Values are shown below.

Report Type	Meaning
00000000	Full Status Message
00000001	Sequence Number Exchange Only/Link Verification
00000010	Single PVC Asynchronous Status (Annex D and Annex A)

FR.3.2.1.2. Keep Alive Sequence/Link Integrity Verification IE

Both the Keep Alive Sequence IE and the Link Integrity Verification IE provide information about whether the interface is still active. The information element is called Keep Alive Sequence for LMI frames and Link Integrity Verification for in-channel signalling frames. In both cases, the router sends a keep alive message to the network to let the network know that the connection to the router is still active. The keep alive signal consists of the current sequence number and the last sequence number received. The network responds with a keep alive response. This sequence number exchange keeps the line active in the absence of traffic.

8	7	6	5	4	3	2	1
0	0	0	0	0	0	1	1
2 (decimal)							
Current Sequence/Send Sequence							
Last Received Seq./Receive Seq. Number							

Figure FR-8 Keep Alive Sequence Information Element format

IE Identifier

The Keep Alive/Link Integrity IE identifier is 03 hexadecimal for Annex D and LMI frames. The Link Integrity IE Identifier is 53 hexadecimal for Annex A.

IE Length

The length of the Keep Alive/Link Integrity IE is 2 octets.

Current Sequence Number/ Send Sequence Number

This field is called Current Sequence Number in LMI frames, and Send Sequence Number in in-channel signalling frames. This field indicates the current sequence number to be sent in a message. It is calculated by incrementing the Last Received Sequence number by one.

Last Received Sequence Number/ Receive Sequence Number

This field is called Last Received Sequence Number for LMI frames, and Receive Sequence Number for in-channel signalling frames. This field indicates the sequence number of the last received message.

FR.3.2.1.3. PVC Status IE

The PVC Status IE provides the following information about a DLCI on the link: whether the DLCI is newly defined and whether the DLCI is active (transmitting and receiving data). LMI frames also indicate whether the DLCI has just been deleted, and whether the DLCI is congested. Status Update messages can contain multiple PVC Status IEs, one for each DLCI defined for the link.

The LMI PVC Status IE format differs from the in-channel signalling PVC Status IE format. Both formats are shown in Figure 9.

PVC Status IE (LMI)

8	7	6	5	4	3	2	1	
0	0	0	0	0	1	1	1	
6 (decimal)								
0	0	0	0	0	0	PVC DLCI (msb)		
PVC DLCI (lsb)								
0	0	0	0	N	D	A	R	PVC Status
PVC Bandwidth (msb)								
PVC Bandwidth								
PVC Bandwidth (lsb)								

PVC Status IE (in-channel signalling, Annex D)

8	7	6	5	4	3	2	1
0	0	0	0	0	1	1	1
	PVC Status IE identifier						
Length of PVC Status contents							
0 ext	0 spare	DLCI (msb)					
1 ext	DLCI (2nd most significant 4 bits)				0	0	0
					spare		
1 ext	0	0	0	0/1	0	0/1	0
	spare			N	spare	A	spare

Figure FR-9 PVC Status Information Element formats

IE Identifier The IE Identifier for the PVC Status IE is 07 hexadecimal in LMI and Annex D frames, and 57 hexadecimal in Annex A frames.

IE Length The length of the PVC IE is 6 octets in LMI frames and 3 octets in Annex D and Annex A frames.

PVC Status DLCI Value This two-octet field indicates the DLCI of the PVC on which the element is reporting. This value is displayed in decimal.

PVC Status The PVC Status IE contains four bits that indicate the status of the PVC, as shown below.

N- New PVC
D- Deleted PVC (LMI only)
A- Active PVC
R- Congested PVC (LMI only)

Bit N	Bit D	Meaning
0	0	Present PVC
0	1	Deleted PVC
1	0	New PVC
1	1	Undefined

PVC Bandwidth (LMI only) The PVC bandwidth field indicates the minimum bandwidth the network has allocated to this PVC, displayed in bits per second.

FR.3.2.1.4. Multicast Status IE (LMI only)

A block of DLCIs are reserved as multicast groups (DLCIs 1019 - 1022 for 2-octet addresses). Multicasting allows a subscriber to transmit a message to all the members of the group with one transmission. When a router sends a frame on one of the multicast DLCIs, the network replicates the frame and delivers it to a pre-defined list of DLCIs, thus broadcasting the frames to a collection of destinations. Status Update messages can contain multiple Multicast Status IEs. The format of the Multicast Status IE is shown in Figure FR-10. Its fields are described below.

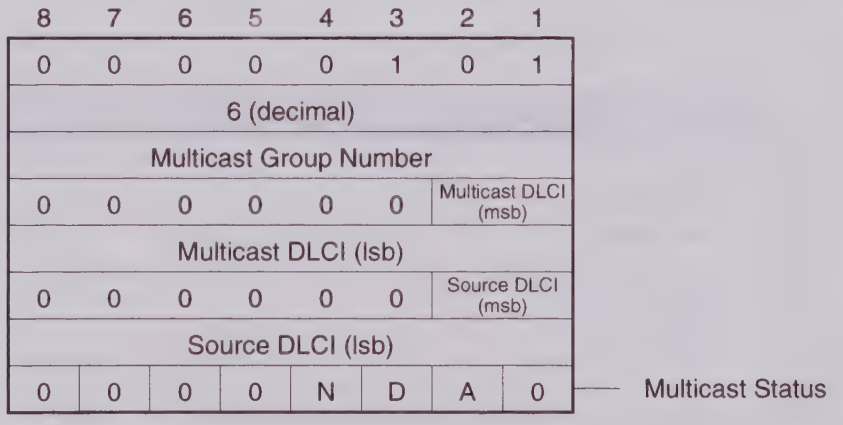

8 7 6 5 4 3 2 1
0 0 0 0 0 1 0 1
6 (decimal)
Multicast Group Number
0 0 0 0 0 0 Multicast DLCI (msb)
Multicast DLCI (lsb)
0 0 0 0 0 0 Source DLCI (msb)
Source DLCI (lsb)
0 0 0 0 N D A 0
Multicast Status

Figure FR-10 Multicast Status Information Element format

IE Identifier The Multicast Status IE identifier is 05 hexadecimal.

IE Length The length of the Multicast Status IE is 6 octets.

Multicast Group Identification If a multicast group is present, this field indicates the mapping between a DLCI and a multicast group virtual circuit.

Multicast DLCI This field contains the multicast DLCI.

Source DLCI The Source DLCI field indicates the multicast message sender's DLCI.

Multicast Status The Multicast Status IE contains three bits that indicate the status of the element, as shown below.

N- New multicast group
D- Deleted multicast group
A- Active multicast group

Bit N	Bit D	Bit A	Meaning
0	0	--	Present multicast group
0	1	--	Deleted multicast group
1	0	--	New multicast group
1	1	--	Undefined
--	--	1	Active multicast group
--	--	0	Inactive multicast group

FR.3.3. Exchange Identification (XID) Header

Frame Relay devices use Exchange Identification (XID) frames to negotiate Data Link Parameters at the initialization of a Frame Relay circuit. The following parameters can be negotiated:

- maximum frame size (transmit and receive)
- retransmission timer
- maximum number of outstanding frames
- window size

Figure FR-11 shows an XID Frame Detail.

```
  W File: frcaptur.an2          Frame Detail                          06-02-92
  G Anlyzr 2: RS232_V.24   In-channel & ext. addr   EXAM MODE        15:57:59
FRLY:   Control ............................... BF          191 d
FRLY:   Format ................................ 82          130 d
FRLY:   Group Identifier ...................... 0F          15 d
FRLY:   Group Length .......................... 000C        12 d
FRLY:
FRLY:   Parameter Identifier .................. 07          7 d
FRLY:     Window size
FRLY:   Parameter Length ...................... 01          1 d
FRLY:   Window size ........................... 00          0 d
FRLY:
FRLY:   Parameter Identifier .................. 00          0 d
FRLY:   Parameter Length ...................... 04          4 d
FRLY:   Parameter Bytes ....................... 69313232    1764831794 d
FRLY:
FRLY:   Parameter Identifier .................. 02          2 d
FRLY:     Retransmission Timer
FRLY:   Parameter Length....................... 01          1 d
FRLY:   Retransmission Timer .................. 02          2 d
FRLY:
Select a trace, frame detail, find, or [Okay] for the previous rack:
   F1       F2       F3       F4       F5       F6       F7       F8       F9       F10
F.RELAY                                                                  FRAME    find
 TRACE                                                                   DETAIL   command
```

Figure FR-11 XID Frame Detail

XID messages begin with the standard Frame Relay header. The header is followed by the negotiated parameters. A list of possible parameter values and their meaning are listed below.

Value	Meaning
05	Transmit frame size
06	Receive frame size
07	Window size
09	Retransmission timer

FR.4. Find Commands and Display Filters

The Frame Relay LPP allows you to search for frames based on:

- LMI
- LMI STATUS
- LMI STATUS ENQUIRY
- LMI STATUS UPDATE
- DATA
- INVALID
- address DLCI (enter a DLCI address 0 - 8,388,607)
- XID (Exchange ID)
- IN.CHAN SIGNAL (in-channel signalling)

There are no display filters available for Frame Relay.

Second Edition October 1993 Release 3.4 and after

Frame Relay

Frame Relay PAL References

FR.1. Introduction

This document explains the protocol-specific PAL keywords included in Version 1.1 of the Frame Relay Layer Protocol Package. Any changes affecting this programming information will be addressed in Release Notes. Directions for installing the LPP on your hard disk and instructions for loading the protocols on the protocol stack can be found in the preface to this manual.

FR.2. Condition Keywords

Condition keywords are the IF portion of an IF-THEN statement. The PAL statement COND-x means "if x is true." The Frame Relay condition keywords are listed below.

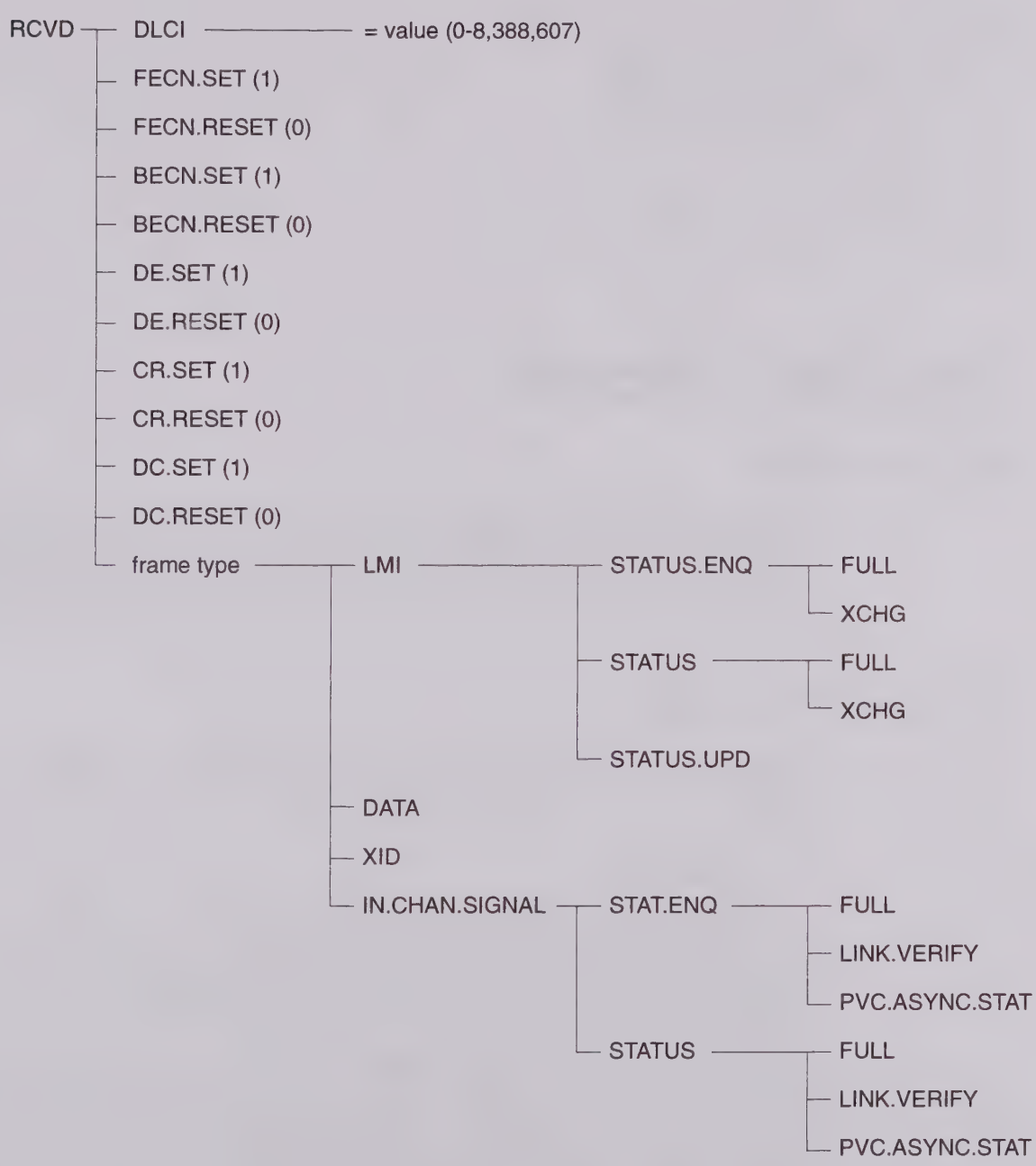
- RCVD
- RCVD.INVALID

The discussion of each keyword includes a syntactical model, a description, and an example. The syntactical model and description explain which parameters are necessary and which are optional when you use the keyword in a Network Event Program. Examples demonstrate the use of the keyword. The examples suggest programming possibilities; they do not constitute a total program and they are not drawn from a real application.

Each condition keyword is one of two types: external or internal. An external condition is something that comes from outside the program, such as a keystroke from the keyboard, a frame from the network, a trigger or a timeout. An internal condition is fulfilled from within the program, as when an accumulator or counter reaches a certain value or a flag variable tests as set or reset. The logical negation of an external condition (an external condition used with NOT) is also internal. With few exceptions, most interface-specific conditions are external, since they occur from a frame.

RCVD

Syntax:



Type: External.

Description: This condition is true when a valid frame is received from the network. This condition does not guarantee that the frame is error free. The RCVD condition is also true when a received frame matches specified parameters. You can specify parameters individually or in combinations in a Network Event program. When you use parameters in combinations, they are logically ANDed. To logically OR two parameters, use a keyword in each statement and specify the OR operator.

RCVD (cont.)

Example:

```
COND RCVD LMI STATUS.ENQ FULL
     RCVD LMI STATUS FULL OR
ACTN MARK.FRAME
```

Remarks: None.

RCVD.INVALID

Syntax: RCVD.INVALID

Type: External.

Description: The RCVD.INVALID condition is true when an invalid Frame Relay frame is received from the network. An invalid frame can be caused by a protocol error or a Frame Check Sequence error.

Example:

```
COND RCVD.INVALID
ACTN PROMPT "Invalid frame received"
```

Remarks: None.

FR.3. Action Keywords

The Frame Relay action keywords are:

- ENHANCE.FRAME
- SEND
- SUPPRESS.FRAME

The discussion of each keyword includes a syntactical model, description, and an example. The syntactical model and description explain which parameters are necessary and which are optional for use with the keyword. Examples demonstrate the use of the keyword. Action keywords are the THEN portion of an IF-THEN statement. The PAL statement ACTN-x means "then execute x."

ENHANCE.FRAME

Syntax: ENHANCE.FRAME

Description: The ENHANCE.FRAME action highlights a frame with reverse video in the Protocol Trace in Run Mode and Examine Mode. ENHANCE.FRAME identifies the frame for later use with the find commands feature in Examine mode. Search for enhanced frames in Examine Mode by using the ENHANCED criteria.

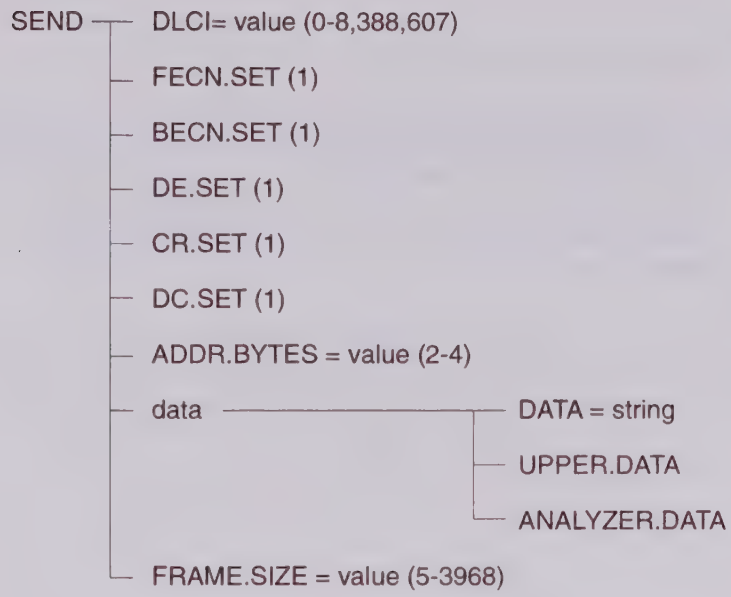
Example:

```
COND RCVD DLCI= 386
ACTN ENHANCE.FRAME
```

Remarks: To execute ENHANCE.FRAME, the program must be processing a frame, not a key from the keyboard, or a timeout variable. For ENHANCE.FRAME to execute, a frame must satisfy the conditions specified in the Network Event Program. It is not possible to enhance a frame from an ANY.KEY condition, a timeout, or a trigger.

SEND

Syntax:



Description: The SEND action transmits a frame with the referenced parameters onto the network. Parameters can be specified individually or in combinations. If the following parameters are not referenced, their default values are assigned:

Parameter	Default
DLCI (2-byte address)	16
DLCI (3-byte address)	1024
DLCI (4-byte address)	131,072
FECN.SET	reset FECN bit (0)
BECN.SET	reset BECN bit (0)
DE.SET	reset DE bit (0)
DC.SET	reset DC bit (0)
CR.SET	reset CR bit (0)
Address bytes	2

The DATA qualifier sends a frame with the string enclosed in quotes as shown below.

Hexadecimal data: "*#00*#12*#7A*#4B"
Character string: "This is a test"

The data includes only the data portion of the frame; it does not include the two-byte header. As with the DATA qualifier, the UPPER.DATA qualifier sends only the data portion of the frame, excluding the two-byte header. UPPER.DATA sends a frame with the data received from the next layer above it in the stack. The ANALYZER.DATA qualifier is only useful in dual analyzer configurations. It sends a frame with the data received from the other analyzer, exclusive of the two-byte header. FRAME.SIZE specifies the length in bytes (5 - 3968) of the transmitted frame. If the data does not fulfill the specified length, the frame is padded with null characters.

SEND (cont.)

Example:

```
COND KEY "aA"
ACTN SEND ANALYZER.DATA FRAME SIZE=2500
```

Remarks: To run an applications using the SEND keyword in a PAL program, the Test Mode field in the mainframe's Line Setup Window for the interface Slot must specify Emulate. To execute SEND, the program must be processing a frame. It should not be processing either a key from the keyboard or a timeout variable. For SEND to execute, a frame must satisfy the conditions specified in the Network Event Program.

SUPPRESS.FRAME

Syntax: SUPPRESS.FRAME

Description: The SUPPRESS.FRAME action suppresses the frame from the Character and Protocol Trace displays, the capture and logging features, and from use in the Network Event Program.

Example:

```
COND FECN.SET
ACTN SUPPRESS.FRAME
```

Remarks: To execute SUPPRESS.FRAME, the program must be processing a frame, not a key from the keyboard, or a timeout variable. For SUPPRESS.FRAME to execute, a frame must satisfy the conditions specified in the Network Event Program. It is not possible to suppress a frame from an ANY.KEY condition, a trigger, or a timeout.

FR.4. PAL BNF Definitions

The BNF definitions for Frame Relay PAL keywords are as follows:

FR.pal.statement	::=	**FR.condition** | **FR.action**
FR.condition	::=	RCVD [**rcvd.qualifiers**] | RCVD.INVALID
rcvd.qualifiers	::=	{[DLCI= **value** | FECN.SET | FECN.RESET | BECN.SET | BECN.RESET | DE.SET | DE.RESET | CR.SET | CR.RESET | DC.SET | DC.RESET | **frame.type**]} any
frame.type	::=	LMI [**lmi.qual**] | DATA | XID | IN.CHAN.SIGNAL [**inchan.qual**]
lmi.qual	::=	STATUS.ENQ [FULL | XCHG] | STATUS | STATUS.UPD [FULL | XCHG]
inchan.qual	::=	STAT.ENQ [FULL | LINK.VERIFY | PVC.ASYNC.STAT] | STATUS [FULL | LINK.VERIFY | PVC.ASYNC.STAT]
FR.action	::=	SEND [**send.qualifiers**] | ENHANCE.FRAME | SUPPRESS.FRAME
send.qualifiers	::=	{[DLCI= **value** | FECN.SET | BECN.SET| DE.SET | CR.SET | DC.SET | ADDR.BYTES= **value1** | **data** | FRAME.SIZE= **size**]} any
data	::=	{[DATA= **string** | UPPER.DATA | ANALYZER. DATA]} any
value	::=	integer value 0 - 8,388,607
value1	::=‘	integer value 2 - 4
size	::=	integer value 5 - 3968
string	::=	see core PAL BNF

Note:

1) “Any” means that items between “{” and “}” can appear in any order, any number of times.
2) “[Object]” means that object is optional.
3) Keywords are in upper case. Words in bold represent supersets of keywords.

Third Edition December 1993 Release 3.4.1 and after

Point-to-Point Protocol Operation

PPP.1. Introduction

This section describes the protocol-specific operation of the DA-3x with Version 1.3 of the Point-to-Point Protocol (PPP) Layer Protocol Package. Version 1.3 can decode previous versions of PPP. Any changes affecting this operating information will be addressed in Release Notes. As of the date this manual was issued the PPP Layer Protocol Package does not include PAL keywords.

Information on installing an LPP on the DA-3x, loading a protocol on the protocol stack, monitoring and examining network traffic, searching for specific frames, and filtering captured traffic is provided in the preface to this manual.

PPP.1.1. Introduction to the PPP Protocol

PPP operates at the OSI Data Link Layer (Layer 2). Developed in 1990 by the Internet Engineering Task Force (IETF) Network Working Group, PPP provides a standard encapsulation protocol for transmitting multi-protocol datagrams over serial point-to-point links. Using a Link Control Protocol (LCP), PPP also addresses the issues of asynchronous and synchronous encapsulation, network protocol multiplexing, link configuration, link quality testing, error detection, and option negotiation for such capabilities as Network Layer address negotiation and data compression negotiation. PPP has three main components. It uses:

- High-Level Data Link Control (HDLC) as a basis for encapsulating datagrams over serial point-to-point links.
- A Link Control Protocol (LCP) for establishing, configuring, and testing the data-link connection.
- A family of Network Control Protocols (NCPs) for establishing and configuring different Network Layer protocols. The PPP LPP does not provide decodes for the NCP protocols.

PPP is capable of operating across any DTE/DCE interface such as T1, V.35, X.21, RS-232 (V.24), RS-449 (V.36), and so forth. The only requirement is a duplex circuit which can be either dedicated or circuit switched. The duplex circuit can operate in either an asynchronous or synchronous bit-serial mode, transparent to PPP Data Link Layer frames.

To establish communications over a point-to-point link, the originator sends the appropriate LCP packets for configuring and testing the data link. After the data link is established and optional facilities are negotiated using LCP packets as needed, the originator sends the appropriate NCP packets to choose and configure one or more Network Layer protocols.

Once the chosen Network Layer protocols are configured, datagrams from each Network Layer protocol can be sent over the link. The link remains configured until an LCP or NCP packet is sent to close the link or until an external event occurs, such as user intervention or the expiration of an inactivity timer.

For further information about Point-to-Point Protocol (PPP), refer to the publication listed below.

The Point-to-Point Protocol (PPP) for the Transmission of Multi-Protocol Datagrams Over Point-to-Point Links, W.A. Simpson, Internet Engineering Task Force (IETF) Network Working Group, Internet Draft, RFC 1331 (Request for Comments), May 1992.

The Point-to-Point Protocol (PPP) Link Quality Monitoring, W.A. Simpson, Internet Engineering Task Force (IETF) Network Working Group, Internet Draft, RFC 1333 (Request for Comments), May 1992.

The Point-to-Point Protocol (PPP) Authentication Protocols, W.A. Simpson, Internet Engineering Task Force (IETF) Network Working Group, Internet Draft, RFC 1334 (Request for Comments), October 1992.

PPP.1.2. Completing the PPP Configuration Menu

When you load PPP on the protocol stack, a configuration menu is available which allows you to configure the PPP LPP to your network. To access the PPP Configuration Menu press F4. Figure PPP-1 shows the Configuration Menu screen for the PPP LPP.

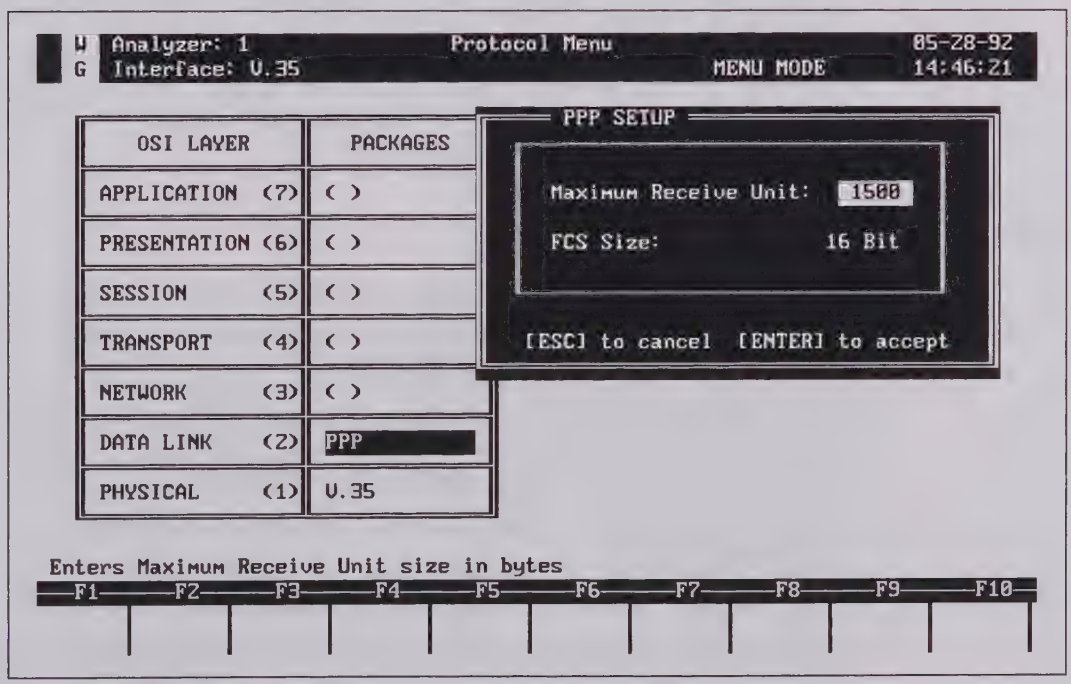


Figure PPP-1 PPP Configuration Menu

The PPP Configuration Menu options, which can be set to configure the PPP LPP to your network, are described below.

Maximum Receive Unit The maximum receive unit is the negotiated maximum packet size used across one direction of the link. By default, the maximum receive unit is 1500 octets. To change this value, position the cursor on the maximum receive unit field of the Configuration menu and enter the desired value. If a packet is transmitted on the network with a maximum receive unit larger than the value specified in the Configuration menu, a warning displays in the Frame Detail.

FCS Size The FCS size is the negotiated size of the frame check sequence checksum field. This field is normally two octets in size. However, consenting PPP implementations may use a four-octet FCS checksum for improved error detection. To change this value, position the cursor on the FCS Size field of the Configuration menu and enter the desired value. The PPP LPP does not verify the value of this field in transmitted packets.

When you have made the desired changes to these fields, press Enter to save your changes and return to the Protocol menu.

PPP.2. Summary Trace

A sample PPP Summary Trace screen is shown in Figure PPP-2. An explanation of each of the Summary Trace fields follows.

W Analyzer: 1 PPP Summary 05-28-92
G Interface: V.35 EXAM MODE 13:40:35

Frame #	DTE-DCE	Protocol	Packet Type	ID	Size	Time
1	<-	IP	-	-	26	09:58:33.49971
2	<-	IP	-	-	27	09:58:37.21712
3	<-	LCP	Configure-Req	1	28	09:58:37.48169
4	<-	LCP	Configure-Ack	3	28	09:58:37.61961
5	<-	LCP	Configure-Nak	5	28	09:58:37.97545
6	<-	LCP	Configure-Rej	7	28	09:58:38.14460
7	<-	LCP	Term-Req	9	39	09:58:38.46793
8	<-	LCP	Term-Ack	11	39	09:58:38.70124
9	<-	LCP	Code-Reject	13	28	09:58:38.88873
10	<-	LCP	Protocol-Rej	15	32	09:58:39.09584
11	<-	LCP	Echo-Request	19	43	09:58:39.29628
12	<-	LCP	Echo-Reply	21	43	09:58:39.78208
13	<-	LCP	Discard-Req	23	43	09:58:39.99123
14	<-	LCP	Link-Qlty-Rpt	25	48	09:58:40.21081
15	<-	Link Qlty Rpt	-	-	54	09:58:40.44121
16	<-	Password Authen	Authen-Req	1	17	09:58:40.68537
17	<-	Password Authen	Authen-Ack	2	15	09:58:41.12579

Select a Protocol Trace, or [Okay] for the previous rack:

F1 F2 PPP TRACE F3 F4 F5 F6 F7 F8 display filters F9 FRAME DETAIL F10 find command

Figure PPP-2 The PPP Summary Trace

Frame # The frame number, in decimal format, is the reference number of a packet. The DA-3x assigns frame numbers in the order it receives frames starting with 1.

DTE - DCE

The DTE - DCE field is not present in the packet format but is provided to indicate the direction in which the packet was sent. The possible values and their meaning are listed below.

Value	Meaning
←	DCE to DTE Traffic
→	DTE to DCE Traffc

Protocol

The protocol field contains a two-octet value which identifies the protocol encapsulated in the information field of the frame. The protocol field is defined by PPP, not HDLC. All protocol values must be odd. The least significant bit of the least significant octet must be 1 and the least significant bit of the most significant octet must be 0. The possible values for the protocol field and their meanings are listed below.

For Network Layer Protocols:

Hexadecimal Value	Meaning
0001 - 001F	Reserved (transparency inefficient)
0021	Internet Protocol
0023	OSI Network Layer
0025	Xerox NS IDP
0027	DECnet Phase IV
0029	AppleTalk
002B	Novell IPX
002D	Van Jacobson Compressed TCP/IP
002F	Van Jacobson Uncompressed TCP/IP
0031	Bridging PDU
0033	Stream Protocol (ST-II)
0035	Banyan Vines
0037	Reserved (until 1993)
00FF	Reserved (compression inefficient)
0201	802.1d Hello Packets
0231	Luxcom
0233	Sigma Network Systems

For Network Control Protocols:

Hexadecimal Value	Meaning
8021	Internet Protocol Control Protocol
8023	OSI Network Layer Control Protocol
8025	Xerox NS IDP Control Protocol
8027	DECnet Phase IV Control Protocol
8029	AppleTalk Control Protocol
802B	Novell IPX Control Protocol
802D	Reserved
802F	Reserved
8031	Bridging Network Control Protocol
8033	Stream Protocol Control Protocol
8035	Banyan Vines Control Protocol

For Control Protocols:

Hexadecimal Value	Meaning
C021	Link Control Protocol
C023	Password Authentication Protocol
C025	Link Qaulity Report Protocol
C223	Challenge/Response Authentication Protocol

Packet Type

The Packet Type field displays the type of packet received. If the protocol encapsulated in the information field is neither an LCP nor a Password Authentication Protocol then a dash (-) is displayed (see Figure PPP-2). There are three classes of LCP packets: Link Configuration Packets, Link Termination Packets, and Link Maintenance Packets. Each class of packets and its corresponding packet types are described below.

Link Configuration Packets

Link Configuration Packets are used to establish and configure a link between points. The four types of Link Configuration Packets are described below.

- Configure-Request
  Configure-Request packet is used to open a connection. It is also used to negotiate configuration options. The sender includes any options it wants to negotiate, along with acceptable values, in the configuration options field.

- Configure-Ack
  A Configure-Ack packet is sent in response to a Configure-Request packet to indicate that all of the configuration options and their values specified in the Configure-Request packet are recognizable and acceptable. The Configure-Ack packet must contain the same value in the identifier field and the same configuration options and values as those contained in the Configure-Request packet to which it is responding. Otherwise, PPP declares the Configure-Ack packet invalid and discards it.

- Configure-Nak
  A Configure-Nak packet is sent in response to a Configure-Request packet to negotiate any of the specified configuration options that the receiver finds unacceptable. The Configure-Nak packet must contain the same value, as the Configure-Request packet, in the identifier field. Otherwise, PPP declares the packet invalid and discards it. The Configure-Nak contains only the configuration options whose values are unacceptable along with values that the receiver finds acceptable. If the receiver requires a specific configuration option that was not requested by the originator, that option may be appended, along with an acceptable value, to the list of configuration options, to request that the originator include it in the next Configure-Request packet. When the originator, of the Configure-Request, receives the Configure-Nak packet, it sends a new Configure-Request packet with the configuration options modified as specified in the Configure-Nak packet.

- Configure-Reject
  A Configure-Reject packet is sent in response to a Configure-Request packet to indicate that some of the specified configuration options are not recognizable or are not acceptable for negotiation (as configured by a network manager). The Configure-Reject packet must contain the same value, as the Configure-Request packet, in the identifier field. Otherwise, PPP declares the packet invalid and discards it. However,

the Configure-Reject contains only the configuration options that it cannot recognize. When the originator, of the Configure-Request, receives the Configure-Reject packet, it sends a new Configure-Request packet which does not include any of the configuration options listed in the Configure-Reject packet.

Link Termination Packets

Link Termination Packets provide a mechanism for closing a connection. The two types of Link Termination Packets are described below.

- Terminate-Request
  A Terminate-Request packet is sent to request the closing of a connection. Terminate-Request packets should be sent until either a Terminate-Ack packet is received, the Physical Layer indicates that it has gone down, or a sufficiently large number have been transmitted such that the originator assumes that the remote end is down.
- Terminate-Ack
  A Terminate-Ack packet is sent in response to a Terminate-Request packet. Receipt of an unelicited Terminate-Ack packet indicates that the connection has been closed.

Link Maintenance Packets

Link Maintenance Packets are used to manage and debug a link. The six types of Link Maintenance Packets are described below.

- Code-Reject
  A Code-Reject packet is sent in response to an LCP packet with an unknown code. An LCP packet containing an unknown code indicates that the LCP implementation of one of the communicating points is faulty or incomplete. The Code-Reject packet is sent by the receiver to the sender of the unknown code packet, along with a copy of the rejected packet in the rejected-packet field. Since it is unlikely that the situation can be rectified automatically, the implementation should make an immediate transition to the closed state and report the error upon receipt of the Code-Reject packet.
- Protocol-Reject
  A Protocol-Reject packet is sent in response to a PPP frame with an unknown Data Link Layer protocol. A PPP packet containing an unknown Data Link Layer protocol indicates that the remote end is attempting to use a protocol which is unsupported at the local end. This typically occurs when the remote end attempts to configure a new, but unsupported protocol. The Protocol-Reject packet is sent by the receiver to the sender of the PPP frame containing the unknown Data Link Layer protocol, along with the rejected protocol identified in the rejected-protocol field and a copy of the information field of the frame in the rejected-information field. Upon receipt of the Protocol Reject packet, the remote end should stop transmitting frames of the indicated protocol. Protocol-Reject packets may only be sent in the LCP open state. If they are received in any other state, they are discarded and no further action is taken.
- Echo-Request
  LCP includes Echo-Request and Echo-Reply codes to provide a Data Link Layer loopback mechanism for use in exercising both directions of the link. This is a useful aid in debugging, link quality determination, performance testing, and numerous other functions. These packets may only be sent in the LCP open state. If they are received in any other state, they are discarded and no further action is taken. An Echo-Request packet is used to request that an Echo-Reply LCP packet be sent.

- Echo-Reply
  An Echo-Reply packet is sent in response to an Echo-Request packet. The Echo-Reply packet should include a copy of the identifier and data fields from the Echo-Request packet.
- Discard-Request
  A Discard-Request packet is sent to exercise the from local to remote direction of the link. It is a useful aid in debugging, performance testing, and numerous other functions. Discard-Requests can only be sent in the LCP open state and are always discarded by the receiver.
- Link-Quality-Report
  A Link-Quality-Report packet is sent, at predefined reporting intervals, to communicate data link performance measurements. If an implementation wants the peer to send Link-Quality-Report packets, then it must negotiate link quality monitoring during the link establishment phase.

ID The identification number field displays the identification number in the packet. Three decimal digits are displayed for a valid LCP packet or a Password Authentication Protocol and a dash (-) for all other protocols.

Size The size field displays four decimal digits to indicate the number of octets in the PPP frame. The count begins with the address byte and includes the FCS octets.

Time The time field indicates the timestamp of the frame, supplied by the DA-3x.

PPP.3. Frame Detail

The Frame Detail provides a detailed analysis of the packet highlighted on the Summary Trace screen. The PPP Frame Detail shows the frame description of the headers as well as the associated decimal, hexadecimal, and binary decodes. A sample LCP 3Frame Detail screen is shown in Figure PPP-3.

```
W File: ppp_cap.anl          Frame Detail                    05-28-92
G Anlyzr 1: V.35                                EXAM MODE    13:42:20
                          N E W   F R A M E
Frame ID .....................................3
Frame Length ..................................... 28
Frame Time ..................................... 09:58:37.48169
PPP:       ------Point-to-Point-Protocol Header ------
PPP:
PPP:  DESCRIPTION                          HEX              BINARY
PPP:  Address (compressed) ............ --
PPP:  Control (compressed) ............ --
PPP:  Protocol (LCP) .................. C021
PPP:  FCS Checksum .................... F389
LCP:
LCP:       ------Link Control Protocol Header------
LCP:
LCP:  DESCRIPTION                          DECIMAL          BINARY
LCP:  Code (Configure-Req) .............1
LCP:  Identifier .......................1
LCP:  Length ...........................24
LCP:  Configuration Options
Select a softkey, or [Okay] for the previous rack:
 F1      F2      F3      F4      F5      F6      F7      F8      F9      F10
         PPP                                             display  FRAME
         TRACE                                           filters  DETAIL
```

Figure PPP-3 LCP Frame Detail – Screen 1 of 2

```
W File: ppp_cap.an1          Frame Detail                    05-28-92
G Anlyzr 1: V.35                                EXAM MODE    13:42:20
LCP:        Length.............................4
LCP:        Max Receive Unit (in bytes) ........1578
LCP:
LCP:        Type (Magic Number) ..............  5
LCP:        Length ...........................  6
LCP:        Magic Number .....................  2750206917
LCP:
LCP:    WARNING: Using the old version of the protocol.  The following field is
LCP:    now RESERVED
LCP:        Type (Link Quality Monitoring) ....  6
LCP:        Length ...........................  6
LCP:        Time Between Reports (Micro-Sec) ..  3000000
LCP:
LCP:        Type (Protocol Compressed) ........  7
LCP:        Length ...........................  2
LCP:
LCP:        Type (Addr & Cntrl Field Cmp) .....  8
LCP:        Length ...........................  2
LCP:
Select a softkey, or [Okay] for the previous rack:
 F1      F2      F3      F4      F5      F6      F7      F8      F9      F10
         PPP                                             display FRAME
         TRACE                                           filters DETAIL
```

Figure PPP-3 LCP Frame Detail – Screen 2 of 2

This format does not include start or stop bits for asynchronous links or any bits or octets inserted for transparency. When asynchronous links are used, all octets are transmitted with one start bit, eight bits of data, and one stop bit. There is no provision for seven-bit asynchronous links.

The PPP Frame Detail for each frame is divided into two headers: the PPP header and the embedded protocol header. To reflect this division, each of the headers is presented separately in this section.

Access the Frame Detail screen in Examine Mode by pressing F9 from the protocol trace softkey rack.

PPP.3.1. PPP Header Frame Detail

PPP packets take the same format as HDLC data packets, as shown in Figure PPP-4. Fields have changed in the PPP header format for Version 1.3, however the package can decode previous versions. An explanation of the Frame Detail fields follows.

Figure PPP-4 PPP Frame Format

Address The address field contains a one-octet value which is the HDLC all-stations (or broadcast) address. PPP does not assign individual station addresses. The value of this field is always set to a hexadecimal value of FF. If this field is compressed, then there is no value to display in the Frame Detail.

Control The control field contains a one-octet value which is the HDLC command for Unnumbered Information (UI) with the Poll/Final bit set to 0. The value of this field is always set to a hexadecimal value of 03. Frames containing any other value in this field are discarded. If this field is compressed, then there is no value to display in the Frame Detail.

Protocol The protocol field contains a two-octet value which identifies the protocol encapsulated in the information field of the frame. Refer to Section PPP.2., Summary Trace, for a list of possible values.

FCS Checksum The frame check sequence checksum field indicates whether a transmission error has occurred. A checksum calculation is performed using a polynomial expression and modulo 2 division. This value is stored in the frame check sequence field and transmitted with the packet. Upon receipt of the packet, PPP verifies the contents of this field by recomputing the checksum and comparing it to the value sent. If the two values are equivalent, then the DA-3x indicates in the Frame Detail that the checksum is good. Otherwise, if the two values are different, the checksum is bad. Although the frame check sequence checksum field is normally two octets, consenting PPP implementations may use a four-octet frame check sequence checksum for improved error detection. However, the PPP LPP does not verify whether or not this field contains a 32-bit frame check sequence.

PPP.3.2. LCP Header Frame Detail

The format for the LCP header is shown in Figure PPP-5. Fields have changed in the LCP header format for Version 1.3, however the package can decode previous versions. An explanation of the Frame Detail fields follows.

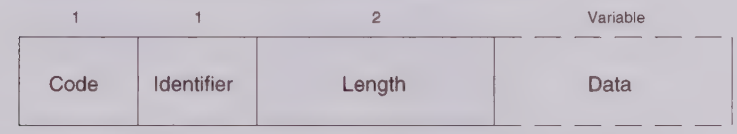


Figure PPP-5 PPP Header Format

Code The code field contains a one-octet decimal value which indicates the type of LCP packet. The possible values and their meanings are listed below.

Decimal Value	Meaning
1	Configure-Request
2	Configure-Ack
3	Configure-Nak
4	Configure-Reject
5	Terminate-Request
6	Terminate-Ack
7	Code-Reject
8	Protocol-Reject
9	Echo-Request
10	Echo-Reply
11	Discard-Request
12	Reserved (for new version)

Identifier The identifier field contains a one-octet decimal value which aids in matching request and replies.

Length The length field contains a two-octet value which indicates the length of the LCP packet including the code, identifier, length, and data fields. Octets outside the range of the length field are Data Link Layer padding and are ignored by the receiver.

Configuration Options Configuration options allow modifications to the standard characteristics of a point-to-point link to be negotiated. The data field is variable in length and may contain one or more configuration options or it may not contain any configuration options. If a configuration option is not included in a Configure-Request packet, the default value for that configuration option is assumed. After negotiation, configuration options only apply to one direction of the link from the originator to the receiver of the Configure-Request packet. The format for the LCP configuration options is shown in Figure PPP-6. An explanation of each of the fields follows.

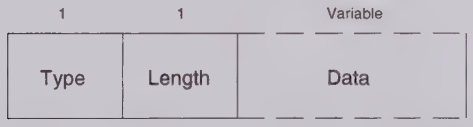


Figure PPP-6 LCP Configuration Options Format

Type The type field contains a one-octet value which indicates the type of the configuration option.

Length The length field contains a one-octet value which indicates the length of the configuration option including the type, length, and data fields.

Value The value field contains the value of the data field.

Table PPP-1 provides a brief description of each of the configuration options and their corresponding fields.

Configuration Option	Description	Type	Length (Octets)	Value
Maximum-Receive-Unit	For negotiating the packet size used across one direction of the link.	1	4	Range: 18-15000 Default: 1500
Async-Control-Character-Map	For negotiating the use of control character mapping on asynchronous links.	2	6	Range: Default: FFFFFFF
Authentication-Protocol	Requires a peer to authenticate itself before allowing Network Layer protocol packets to be exchanged. An implementation may allow the peer to pick from more than one authentication protocol by including them in its Configure-Request packets.	3	4	C023 Password Authentication Protocol C223 Challenge/ Response Authentication Protocol
Quality-Protocol	For negotiating the use of a specific protocol for link quality monitoring.	4	8	C025 Link Quality Report
Magic-Number	For detecting looped-back links and other Data Link Layer anomalies.	5	6	Range: 00000001 or FFFFFFFF Default: None
Reserved	Reserved for future use.	6		
Protocol-Field-Compressed	For negotiating the compression of the Data Link Layer protocol field. By default, all implementations of PPP must transmit standard PPP frames with two-octet protocol fields. However, this field may be compressed into a single-octet to conserve bandwidth for low speed asynchronous links.	7	2	Default: Not compressed
Address-and-Control-Field-Compressed	For negotiating the compression of the Data Link Layer address and control fields. By default, all implementations must transmit frames with an address field of FF and a control field of 03. Since these fields have constant values, they may be compressed by omitting them.	8	2	Default: Not compressed
32-Bit-FCS	For negotiating a 32-bit frame check sequence.	9	2	Default: 16-bit FCS

Table PPP-1 LCP Configuration Options

PPP.3.3. Link-Quality-Report Packet Frame Detail

The format for the Link-Quality-Report packet is shown in Figure PPP-7.

Magic-Number	123456789
LastOutLQRs	0123
LastOutPackets	4567
LastOutOctets	8900
PeerInLQRs	9876
PeerInPackets	5432
PeerInDiscards	1000
PeerInErrors	1
PeerInOctets	12
PeerOutLQRs	123
PeerOutPackets	1234
PeerOutOctets	12345

Figure PPP-7 Link-Quality-Report Packet

The Frame Detail for the Link-Quality-Report packet is shown in Figure PPP-8. An explanation of each of the fields follows.

```
 W File: ppp_cap.ani          Frame Detail                    05-28-92
 G Anlyzr 1: V.35                                EXAM MODE    13:42:20
LQR:
LQR:        ------Link Quality Report Protocol Header------
LQR:
LQR:  DESCRIPTION                        DECIMAL          BINARY
LQR:  Magic Number ..................... 123456789
LQR:  Last Out LQRs .................... 123
LQR:  Last Out Packets ................. 4567
LQR:  Last Out Octets .................. 8900
LQR:  Peer in LQRs ..................... 9876
LQR:  Peer In Packets .................. 5432
LQR:  Peer In Discards ................. 1000
LQR:  Peer In Errors ................... 1
LQR:  Peer In Octets ................... 12
LQR:  Peer Out LQRs .................... 123
LQR:  Peer Out Packets ................. 1234
LQR:  Peer Out Octets .................. 12345
LQR:
LQR:
Select a softkey, or [Okay] for the previous rack:
 F1      F2      F3      F4      F5      F6      F7      F8      F9      F10
         PPP                                             display  FRAME
         TRACE                                           filters  DETAIL
```

Figure PPP-8 Link-Quality-Report Packet Frame Detail

Magic-Number The Magic-Number field aids in detecting links which are in the looped-back condition. Unless modified by a Configuration Option, the Magic-Number must be transmitted as zero and must be ignored on reception. If Magic-Numbers have been negotiated, incoming LQR packets should be checked to ensure that the local end is not seeing its own Magic-Number and thus a looped-back link. See the Magic-Number Configuration Option for further explanation.

LastOutLQRs The LastOutLQRs field is copied from the most recently received PeerOut LQRs on transmission.

LastOutPackets The LastOutPackets field is copied from the most recently received PeerOutPackets on transmission.

LastOutOctets The LastOutOctets field is copied from the most recently received PeerOut Octets on transmission.

PeerInLQRs The The PeerInLQRs field is copied from the most recently received SaveInLQRs on transmission.

Whenever the PeerInLQRs field is discovered to be zero, the LastOut... fields are indeterminate, and the PeerIn... fields contain the initial values for the peer.

PeerInPackets The PeerInPackets field is copied from the most recently received SaveInPackets on transmission.

PeerInDiscards The PeerInDiscards field is copied from the most recently received SaveInDiscards on transmission.

PeerInErrors The PeerInErrors field is copied from the most recently received SaveInErrors on transmission.

PeerInOctets The PeerInOctets field is copied from the most recently received SaveInOctets on transmission.

PeerOutLQRs The PeerOutLQRs field is copied from OutLQRs on transmission. This number must include this LQR.

PeerOutPackets The PeerOutPackets field is copied from the current MIB ifOutUniPackets and ifOutNUniPackets on transmission. This number must include this LQR.

PeerOutOctets The PeerOutOctets field is copied from the current MIB ifOutOctets on transmission. This number must include this LQR.

PPP.3.4. Password Authentication Protocol Packet Frame Detail

The format for the Password Authentication Protocol (PAP) packet is shown in Figure PPP-9.

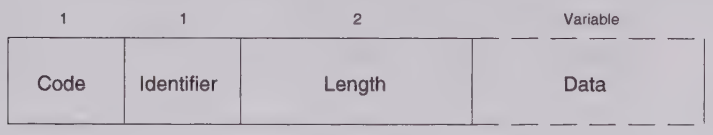


Figure PPP-9 PAP Frame Format

The Frame Detail for the data field of a Password Authentication Protocol packet is shown in Figure PPP-10. An explanation of each of the fields follows:

```
W File: ppp_cap.an1          Frame Detail                    05-28-92
G Anlyzr 1: V.35                                EXAM MODE    13:42:20
PAP:
PAP:        ------Password Authentication Protocol (PAP) Header------
PAP:
PAP:  DESCRIPTION                          DECIMAL          BINARY
PAP:  Code (Authen-Req) ..............     1
PAP:  Identifier .....................     1
PAP:  Length .........................     11
PAP:  Peer-ID Length .................     02 h
PAP:
PAP:  Uninterpreted PAP Peer-ID Dump:
PAP:
PAP:  FF FF                                ___
PAP:
PAP:  Password Length ................     03 h
PAP:
PAP:  Uninterpreted PAP Password Dump:
PAP:
PAP:  FF FF FF                             ___
PAP:
Select a softkey, or [Okay] for the previous rack:
F1      F2      F3      F4      F5      F6      F7      F8      F9      F10
        PPP                                             display FRAME
        TRACE                                           filters DETAIL
```

Figure PPP-10 Password Authentication Protocol Frame Detail

Code The Code field identifies the type of PAP packet. PAP codes are assigned as follows:

1 Authenticate-Request
2 Authenticate-Ack
3 Authenticate-Nak

Identifier The Identifier field aids in matching requests and replies.

Length The Length field indicates the length of the PAP packet including the Code, Identifier, Length and Data fields. Octets outside the range of the Length field should be treated as Data Link Layer padding and should be ignored on reception.

Data The Data field format is determined by the Code field.

PPP.3.4.1. Authenticate-Request Packet

The format for the Authenticate-Request packet is shown in Figure PPP-11. An explanation of each of the fields follows.

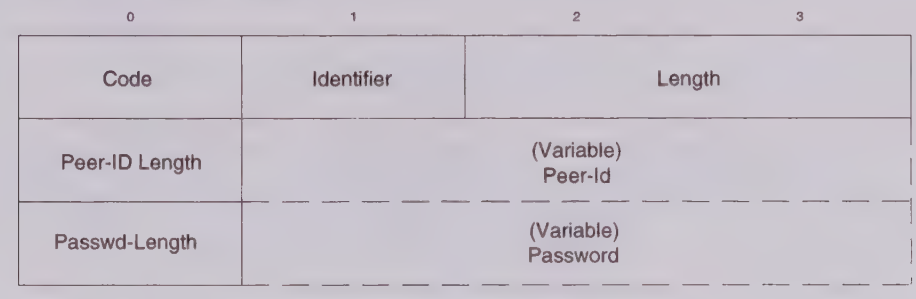


Figure PPP-11 Authenticate-Request Packet Format

Code 1 is the code for Authenticate-Request.

Identifier The Identifier field aids in matching requests and replies. The Identifier field must be changed each time an Authenticate-Request packet is issued.

Length The Length field indicates the length of the Authenticate-Request field.

Peer-ID-Length The Peer-ID-Length field indicates the length of the Peer-ID field.

Peer-ID The Peer-ID field indicates the name of the peer to be authenticated.

Passwd-Length The Passwd-Length field indicates the length of the Password field.

Password The Password field indicates the password to be used for authentication.

PPP.3.4.2. Authenticate-Ack/Authenticate-Nak Packet

The format for the Authenticate-Ack/Authenticate-Nak packet is shown in Figure PPP-12. An explanation of each of the fields follows.

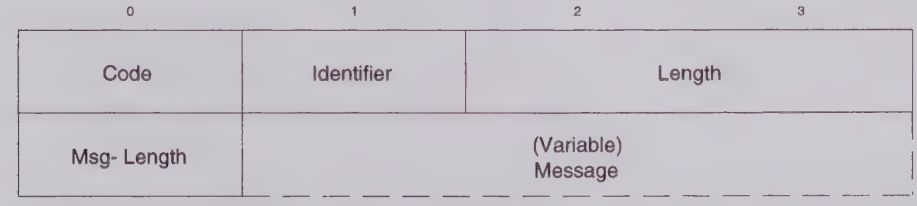


Figure PPP-12 Authenticate-Ack/Authenticate-Nak Packet Format

Code 2 is the code for Authenticate-Ack.
3 is the code for Authenticate-Nak.

Identifier The Identifier field aids in matching requests and replies. The Identifier field must be copied from the Identifier field of the Authenticate-Request which caused this reply.

Length The Length field indicates the length of the Authenticate-Ack/Authenticate-Nak packet.

Msg-Length The Msg-Length field indicates the length of the Message field.

Message The Message field is zero or more octets and its contents are implementation dependent. It is intended to be human readable, and must not affect operation of the protocol. It is recommended that the message contain displayable ASCII characters 32 through 126 decimal. Mechanisms for extension to other character sets are the topic of future research.

PPP.3.4.3. Challenge-Handshake Authentication Protocol

The Challenge-Handshake Authentication Protocol (CHAP) verifies the identity of a peer by using a 3-way handshake with a secret hash value. The format of the Authentication-Protocol Configuration Option to negotiate the Challenge-Handshake Authentication Protocol is shown in Figure PPP-13. An explanation of each of the fields follows.

Type The Type field contains a value of 3.

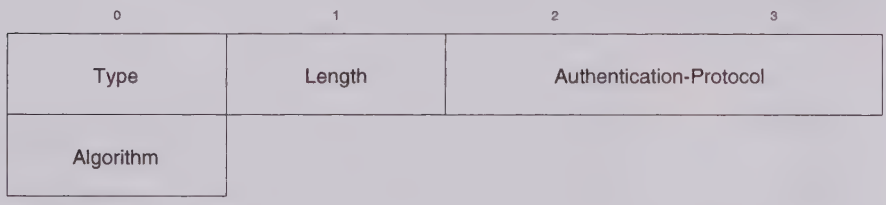


Figure PPP-13 Authentication-Protocol Configuration Option Format

Length The Length field contains a value of 5.

Authentication-Protocol The Authentication-Protocol field contains a value of C223 (hex).

Algorithm The Algorithm field indicates the one-way hash method to be used. The most up-to-date values of the CHAP Algorithm field are specified in the most recent "Assigned Numbers". Current values are assigned as follows:

Value	Meaning
0 - 4	unused (reserved)
5	MD5

PPP.4. Find Commands and Display Filters

The PPP LPP allows you to search for frames and filter captured traffic based on:

- AppleTalk
- AppleTalk CP
- Banyan Vines
- Banyan Vines CP
- Bridge NCP
- Bridge PDU
- Challenge/Resp
- CMP TCP/IP
- DECnet Phase IV
- DECnet IV CP
- IP
- IP CP
- LCP
- Link Qlty Rpt
- Luxcom
- Novell IPX
- Novell IPX CP
- OSI Network
- OSI Network CP
- Password Authen
- Sigma Net Sys
- Stream Protocol
- Stream Prtcl CP
- Uncmp TCP/IP
- Xerox NS IDP
- Xerox NS IDP CP
- 802.1d Hello

find lcp (F2)

- Code-Reject
- Configure-Ack
- Configure-Nak
- Configure-Rej
- Configure-Req
- Discard-Req
- Echo-Reply

- Echo-Request
- Link-Qlty-Rpt
- Protocol-Rej
- Term-Ack
- Term-Req

First Edition May 1993 Release 3.3.5 and after

Cisco SLE

Cisco SLE Protocol Operation

SLE.1. Introduction

This section describes the protocol-specific operation of the DA-3x with Version 1.0 of the Cisco Serial Line Encapsulation (SLE) Layer Protocol Package (LPP). Any changes affecting this operating information will be addressed in Release Notes. As of the publication date of this manual, the Cisco SLE LPP does not include PAL keywords.

Cisco SLE operates at the OSI Data Link Layer (Layer 2). It is a proprietary protocol used by Cisco routers for encapsulating upper layer information for transmission between two networks. Cisco SLE uses HDLC framing for encapsulation on synchronous serial lines.

In addition to encapsulating upper layer protocols, Cisco SLE frames also carry a proprietary Cisco protocol known as SLARP (Serial Line Address Resolution Protocol). There are three types of SLARP packets: SLARP Request, SLARP Reply, and SLARP Linecheck. SLARP Request and Reply packets performs dynamic IP address determination, while SLARP Linecheck packets perform the serial line keep-alive function.

For further information about the Cisco SLE protocol, refer to the publication listed below.

Cisco Serial Line Encapsulation, Cisco Systems, Inc., Menlo, Park, CA, August 23, 1991.

SLE.2. Summary Trace

To access the Summary Trace screens, press F3 (protocl traces) from the top softkey rack. Press F2 (CIS.SLE TRACE). The Cisco SLE Summary Trace displays the most relevant fields for the PDU. A sample Cisco SLE Summary Trace screen is shown in Figure SLE-1. A brief explanation of each of the Summary Trace fields follows.

```
W File: Analyzr1.RAM        CISCO.SLE Summary                  03-26-93
G Anlyzr 1: RS232_V.24                          EXAM MODE      12:29:20
Frame #  | DTE-DCE | Address   | Protocol                      | Time
---------------------------------------------------------------------------
69          ->      broadcast   ISO CLNP/ISO ES-IS DSAP/SSAP    10:17:32.09596
70          <-      unicast     IP                             10:17:32.20595
71          ->      AA          cisco SLARP (REQUEST)          10:17:32.37932
72          <-      BB          cisco SLARP (REPLY)            10:17:32.53721
73          <-      unicast     IP                             10:17:33.36723
74          ->      UNKNOWN: PDU too Short                     10:17:33.45388
75          <-      unicast     1111                           10:17:33.65056
76          ->      broadcast   0011                           10:17:33.74054
77          <-      unicast     DEC bridge spanning tree prot. 10:17:33.85430
78          ->      unicast     cisco SLARP (LINECHECK)        10:17:33.99097
79          <-      unicast     0011                           10:17:35.48806
80          ->      broadcast   0011                           10:17:35.99808
81          ->      AA          0011                           10:17:36.50806
82          ->      unicast     PUP                            10:17:36.95142
83          <-      unicast     XNS                            10:17:37.21142
84          ->      unicast     IP                             10:17:37.54809
85          <-      unicast     Chaos                          10:17:37.84144
Select a softkey, or [Okay] for the previous rack:
F1 | F2 CIS.SLE TRACE | F3 | F4 | F5 | F6 | F7 | F8 display filters | F9 FRAME DETAIL | F10 find command
```

Figure SLE-1 Cisco SLE Summary Trace

Frame # The frame number, in decimal format, is the reference number of the frame. The DA-3x assigns frame numbers in the order it receives frames, starting with 1.

DTE-DCE The DTE-DCE field indicates the direction of the traffic. The possible values and their meanings are:

Value	Meaning
->	Frame generated by the DTE and sent to the DCE
<-	Frame generated by the DCE and sent to the DTE

Address The address field indicates the destination of the frame. The possible values and their meanings are:

Value	Meaning
00-FF	Destination node
0F	Unicast message
8F	Broadcast message

Ctrl The control field is reserved and always contains a value of zero.

Protocol The protocol field shows the higher layer protocol encapsulated in the information field. The protocol is usually identified by an Ethernet type code; however, Cisco has added some additional codes to identify packet types that do not appear on Ethernet networks. The possible values and their meaning are:

Ethernet Standard Values:

Hexadecimal Value	Ethertype
0200	PUP
0600	XNS
0800	IP
0804	Chaos
0806	ARP
0BAD	Vines IP
0BAF	Vines Echo
6003	DECnet Phase IV
8019	Apollo Domain
8035	Cisco SLARP
8038	DEC Bridge Spanning Tree Protocol
809B	Apple EtherTalk
80F3	AppleTalk ARP
8137	Novell IPX

Cisco-Defined Values:

Hexadecimal Value	Cisco Type
0808	Frame Relay ARP
4242	IEEE Bridge Spanning Protocol
6558	Bridged Ethernet/802.3 Packet
FEFE	ISO CLNP/ISO ES-IS DSAP/SSAP

If the value in the protocol field does not match either an Ethernet standard value or a Cisco-defined value, then the Cisco SLE LPP displays the field's contents as a hexadecimal value.

Time The time field indicates the time at which the DA-3x received the frame. The format of the timestamp is HH:MM:SS.sssss.

SLE.3. Frame Detail

Access the Frame Detail screen in Examine Mode by pressing F9 from the protocol trace softkey rack. Frame Detail provides a detailed analysis of the packet highlighted on the Summary Trace screen. The Cisco SLE Frame Detail shows the frame description of the headers as well as the associated hexadecimal and binary decodes.

SLE.3.1. Frames Containing Upper Layer Protocols

The Cisco SLE PDU format is shown in Figure SLE-2.

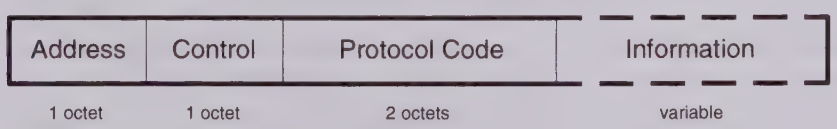


Figure SLE-2 Cisco SLE PDU Format

A sample Cisco SLE Frame Detail screen, for a frame containing an upper layer protocol, is in shown in Figure SLE-3. An explanation of the Frame Detail fields follows.

```
W File: Analyzr1.RAM          Frame Detail                    03-26-93
G Anlyzr 1: RSZ32_V.24                          EXAM MODE     12:28:21
                              N E W   F R A M E
Frame ID ..................................... 21
Frame Length ................................. 14
Frame Time ................................... 10:17:06.48992
SLE:
SLE:        ------ CISCO Serial Line Encapsulation Header ------
SLE:
SLE:    DESCRIPTION                           HEX        BINARY
SLE:    Address (unicast) ..................  0F
SLE:    Control ............................  00
SLE:    Protocol (IP) ......................  0800
SLE:    CRC Checksum (FCS) .................  923C
SLE:
IP:                  ------  INTERNET PROTOCOL HEADER  ------
IP:
IP:     DESCRIPTION                           HEX        BINARY
IP:     Version ............................  04         4 d
IP:     Header Length (Octets) .............  14         20 d
IP:     Type of Service ....................  20         0010 0000
Select a softkey, or [Okay] for the previous rack:
 F1      F2        F3      F4      F5      F6      F7      F8        F9        F10
         CIS.SLE                                         display   FRAME     find
         TRACE                                           filters   DETAIL    command
```

Figure SLE-3 Cisco SLE Frame Detail

Address The address field indicates the destination of the frame. The possible values and their meanings are:

Value	Meaning
00-FF	Destination node
0F	Unicast message
8F	Broadcast message

Ctrl The control field is reserved and always contains a value of zero.

Protocol The protocol field shows the higher layer protocol encapsulated in the information field. The protocol is usually identified by an Ethernet type code; however, Cisco has added some additional codes to support packet types that do not appear on Ethernet networks. For a list of the possible values, refer to Section SLE.2., "Summary Trace."

CRC Checksum The cyclic redundancy check (CRC) checksum field indicates whether a transmission error has occurred. The calculated checksum value is compared to the transmitted checksum value.

SLE.3.2. Frames Containing SLARP

The packet format and Frame Detail fields for each of the three SLARP packets are provided in the following sections.

SLE.3.2.1. SLARP Request and SLARP Reply Packets

The packet format for SLARP Request and SLARP Reply packets is shown in Figure SLE-4.

Figure SLE-4 Cisco SLE Packet Format for SLARP Request and Reply Packets

A sample Cisco SLE Frame Detail screen, for a frame containing a SLARP Request, is in shown in Figure SLE5. An explanation of the Frame Detail fields follows.

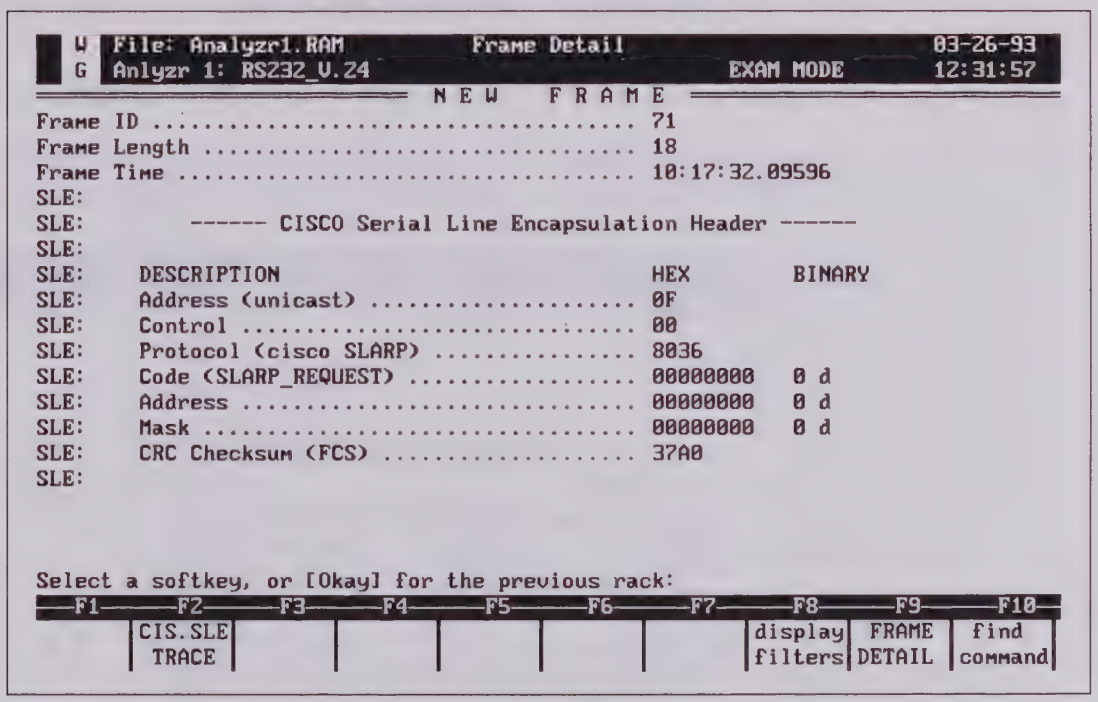

U File: Analyzr1.RAM Frame Detail 03-26-93
G Anlyzr 1: RS232_V.24 EXAM MODE 12:31:57
NEW FRAME
Frame ID 71
Frame Length 18
Frame Time 10:17:32.09596
SLE:
SLE: ------ CISCO Serial Line Encapsulation Header ------
SLE:
SLE: DESCRIPTION HEX BINARY
SLE: Address (unicast) 0F
SLE: Control 00
SLE: Protocol (cisco SLARP) 8036
SLE: Code (SLARP_REQUEST) ..... 00000000 0 d
SLE: Address ..... 00000000 0 d
SLE: Mask ..... 00000000 0 d
SLE: CRC Checksum (FCS) 37A0
SLE:
Select a softkey, or [Okay] for the previous rack:
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
CIS.SLE TRACE
display filters
FRAME DETAIL
find command

Figure SLE-5 Cisco SLE Frame Detail for SLARP Requests and Replies

Address The address field indicates the destination of the frame. The possible values and their meanings are:

Value	Meaning
00-FF	Destination node
0F	Unicast message
8F	Broadcast message

Control The control field is reserved and always contains a value of zero.

Protocol The protocol field indicates that the frame contains the Cisco SLARP protocol.

Code The code field indicates the SLARP packet type. A code value of 0 indicates a SLARP Request and a code value of 1 indicates a SLARP Reply.

IP Address For SLARP Request packets, the IP address field is set to 0. For SLARP Reply packets, the IP address field contains the IP address of the replying system.

Mask For SLARP Request packets, the mask field is set to 0. For SLARP Reply

packets, the mask field contains the IP subnet mask to be used.

CRC Checksum The cyclic redundancy check (CRC) checksum field indicates whether a transmission error has occurred. The calculated checksum value is compared to the transmitted checksum value.

SLE.3.2.2. SLARP Linecheck Packets

The packet format for SLARP Linecheck Packets is shown in Figure SLE-6.

Figure SLE-6 Cisco SLE Packet Format for SLARP Requests and Replies

A sample Cisco SLE Frame Detail screen, for a frame containing a SLARP Linecheck packet, is in shown in Figure SLE-7. An explanation of the Frame Detail fields follows.

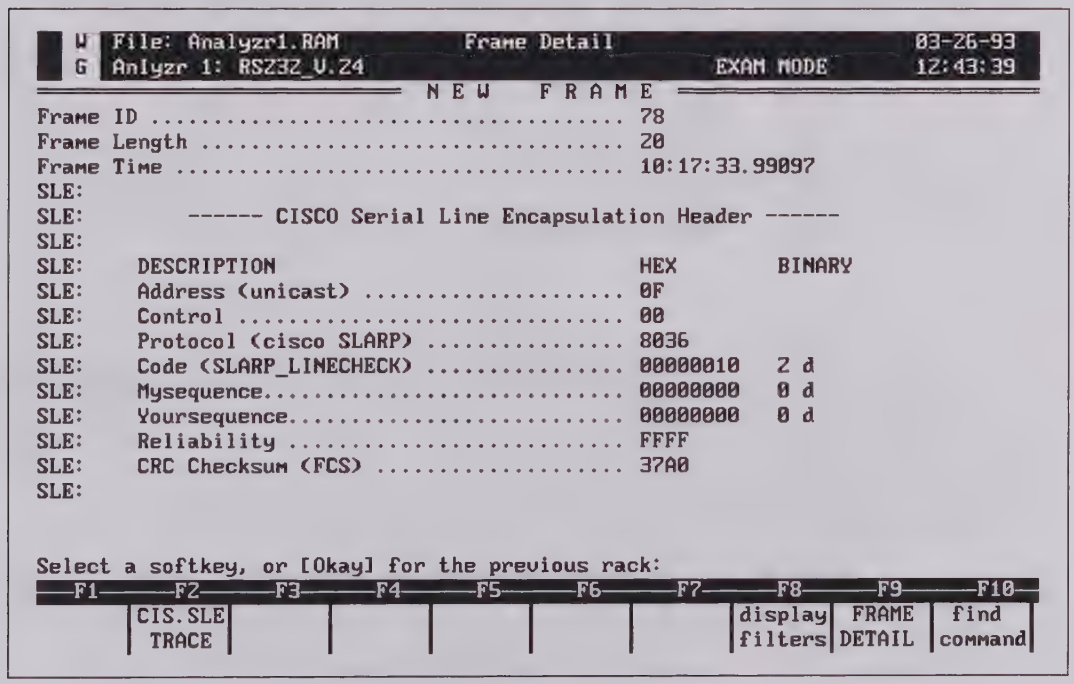

W File: Analyzr1.RAM Frame Detail 03-26-93
G Anlyzr 1: RSZ3Z_V.Z4 EXAM MODE 12:43:39
NEW FRAME
Frame ID 78
Frame Length 20
Frame Time 10:17:33.99097
SLE:
SLE: ------ CISCO Serial Line Encapsulation Header ------
SLE:
SLE: DESCRIPTION HEX BINARY
SLE: Address (unicast) 0F
SLE: Control 00
SLE: Protocol (cisco SLARP) 8036
SLE: Code (SLARP_LINECHECK) ..... 00000010 2 d
SLE: Mysequence..... 00000000 0 d
SLE: Yoursequence..... 00000000 0 d
SLE: Reliability ..... FFFF
SLE: CRC Checksum (FCS) 37A0
SLE:
Select a softkey, or [Okay] for the previous rack:
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
CIS.SLE TRACE
display filters
FRAME DETAIL
find command

Figure SLE-7 Cisco SLE Frame Detail for SLARP Linecheck Packets

Address The address field indicates the destination of the frame. The possible values and their meanings are:

Value	Meaning
00-FF	Destination node
0F	Unicast message
8F	Broadcast message

Control The control field is reserved and always contains a value of zero.

Protocol The protocol field indicates that the frame contains the Cisco SLARP protocol.

Code	The code field indicates the SLARP packet type. A code value of 2 indicates a SLARP Linecheck packet.
Mysequence	The mysequence field contains the sequence number for the current packet.
Yoursequence	The yoursequence field contains the returned sequence number, which is the sequence number of the last keep-alive packet received.
Reliability	The reliability field is reserved for future use and is always set to a hexadecimal value of FFFF.
CRC Checksum	The cyclic redundancy check (CRC) checksum field indicates whether a transmission error has occurred. The calculated checksum value is compared to the transmitted checksum value.

SLE.4. Find Commands and Display Filters

The Cisco SLE LPP allows you to search for frames and filter captured frames based on:

(F1) **addr**

- Unicast
- Broadcast

(F2) **protocol**

- AppleTalk ARP
- Apollo Domain
- Bridged Ethernet/802.3 Packet
- Chaos
- ISO CLNP/ISO ES-IS DSAP/SSAP
- DECnet Phase IV
- DEC Bridge Spanning Tree Protocol
- Apple EtherTalk
- Frame Relay ARP
- IEEE Bridge Spanning Protocol
- IP
- Novell IPX
- PUP
- Cisco SLARP
- ARP
- Vines IP
- Vines Echo
- XNS

(F3) **invalid pdu**

- PDU too short
- PDU header is sliced
- Bad CRC Checksum
- PDU is aborted
- Invalid SLARP Packet

X.21 Interface Operation Errata Sheet
March 1994

This is an errata sheet to the X.21 Interface Operation document, which is located in the *Line Interface Operation* binder.

As of Release 3.4.2, the maximum frame size on high speed WAN interfaces is 3984 bytes. The maximum frame size on standard WAN interfaces is 4012 bytes. This refers to the maximum frame size that can be displayed, not the maximum frame size that can be captured by the DA-3x. If a frame longer than the size limit is received its length is displayed as the maximum length (3984 or 4012), and only that number of bytes is displayed in the frame detail and character trace. All frames, including those that exceed the maximum frame size, can be captured by the DA-3x.

Frame size references are made on the following pages of the X.21 Interface Operation document.

Section X21.7.1.1: Receiver (or Playback) Activity

page X.21-24:

- Longest Frame - the size (in bytes) of the longest frames that has been received since receiving began. The maximum frame size that can be received is 4012 bytes.

Section HSX21.5.1.1: Receiver Activity

page HSX.21-10

- Longest Frame - the size (in bytes) of the longest frame that has been received since receiving began. The maximum frame size that can be received is 3984 bytes.

Fifth Edition October 1993 Release 3.4 and after

X.21

X.21 Interface Operation

X21.1. Introduction

X.21 is a CCITT recommended interface between Data Terminating Equipment (DTE) and Data Circuit Terminating Equipment (DCE) for synchronous operation on Public Data Networks. It defines the physical specifications and control procedures required for initiating and clearing a connection. X.21 uses a different interfacing procedure than others normally associated with physical layer interfaces. It assigns coded character strings to individual functions rather than assign a specific function to an individual pin. It also requires fewer control circuits than the V-series interfaces – making it suitable for use in Circuit-Switched Data Networks.

The X.21 Interface gives the DA-30 the ability to monitor and/or emulate a DTE or DCE on a Wide Area Network (WAN). Figure X21-1 shows where the DA-30 fits into a WAN communications system.

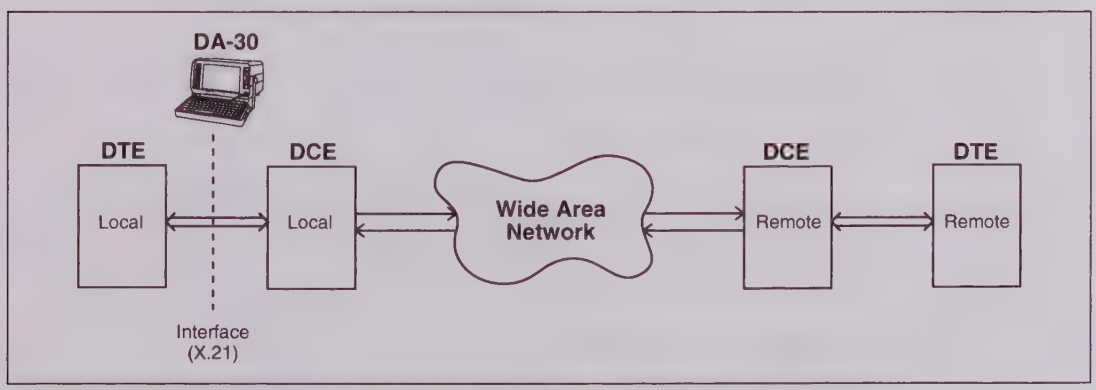


Figure X21-1 DA-30 in a WAN Communications System

The X.21 Interface provides for three operating modes: emulate DTE, emulate DCE, and monitor. It can also transmit and receive using both synchronous and asynchronous data formats.

This document describes the installation, external connections, and the software setup for the X.21 Line Interface Module.

X21.2. Installation

The X.21 Interface derives its basic functionality from the following:

- Line Interface Module (LIM)—circuit board
- WAN Feature Module
- Line Interface Package (LIP)
- Layer Protocol Package (LPP)

> **Note:**
>
> Before you can use the X.21 Interface, you must also have a Protocol Analyzer Module and a WAN Feature Module installed.

X21.2.1. Installing the LIM and Installing LIP & LPP Software on the Hard Disk

Installing the LIM:

For instructions on how to install the X.21 LIM, refer to the installation procedures described in the "Installing Hardware Accessories" appendix of the *DA-30/31 Operating Manual.*

Installing the LIP & LPP Software:

For instructions on how to install the LIP & LPP software onto the hard disk, refer to the installation procedures described in the "Installing Software" appendix of the *DA-30/31 Operating Manual.*

X21.2.2. Loading the LIP & LPP Software

Before using your DA-30 for WAN testing, you should load the LPP software on the OSI protocol stack and then load the LIP software in the card slot containing the LIM.

To load the LPP software:

From the Main Menu, access the protocol stack by moving the cursor to the Active Protocols field within the current Analyzer window and pressing F2 (protocol stack). When the protocol stack appears, move the cursor to the Physical Layer (1), press F1 (view options), and select the X.21 package from the list.

To load the LIP software:

Move the cursor to the card slot window that corresponds to the slot containing the LIM. Press F1 (view options). Move the cursor to the X.21 package and press Enter.

X21.3. Making The Connections

A DB15 four-connector cable is provided so that you can make the necessary interface connections for your testing. See Figure X21-2. The four-connector cable has two, 15-pin connectors on each end. One is male, and the other is female to give you connection flexibility. The same signals are available on all of the connectors. For some testing configurations, you will need an additional DB15 cable.

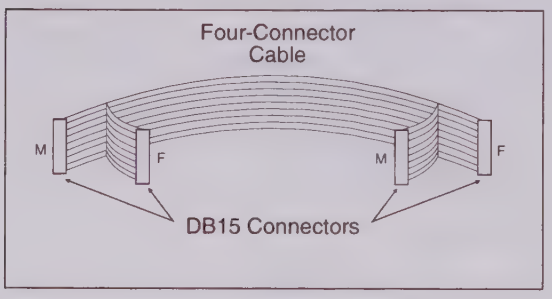


Figure X21-2 Four-Connector Cable

X21.3.1. The Rear Panel

Figure X21-3 shows the rear panel of the X.21 Line Interface Module.

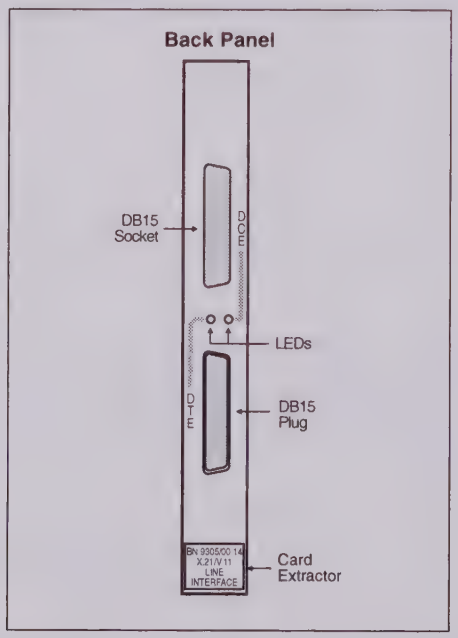


Figure X21-3 Rear Panel of X.21 Line Interface Module

X21.3.1.1. Connectors

The LIM provides two 15-pin (DB15) connectors on the rear panel. The top connector (female) is labelled DCE, and the bottom connector (male) is labelled DTE. The connector labels refer to the identity of the DA-30 during emulation.

X21.3.1.2. Connector LEDs

Between the two DB15 connectors are two orange LEDs. The left LED corresponds to the DTE connector, and the right LED corresponds to the DCE connector. These LEDs indicate the LIM's test mode as shown in Table 1.

DTE LED	DCE LED	Test Mode
OFF	OFF	Monitor
ON	OFF	Emulate DTE
OFF	ON	Emulate DCE

Table 1 Connector LEDs and the Test Mode

X21.3.1.3. Interface Signals

Six of the 15 specified, balanced interface signals can be driven or monitored by the LIM. See Figure X21-4. Each signal has a corresponding LED on the front panel that indicates its status. The LIM also supports the optional X clocking (described in CCITT X.24 recommendation). When used, the leads that normally carry the B (byte timing) signal are used to carry the X clock. The front panel LEDs and LED Overlay are discussed in the "Front Panel LEDs" section.

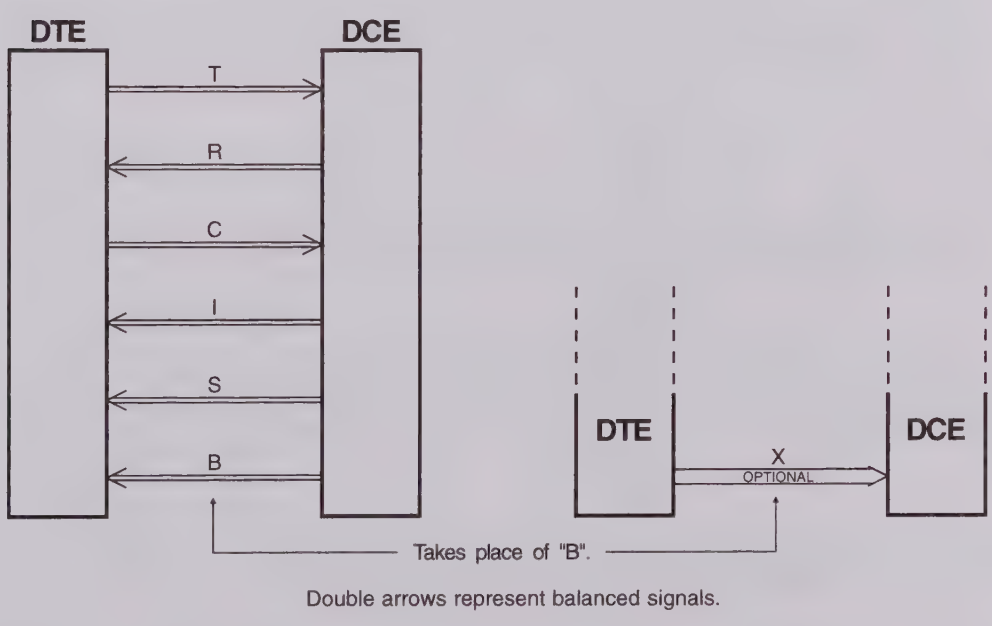


Figure X21-4 Supported Interface Signals

X21.3.2. Connecting For Monitoring

When in the Monitor mode, the LIM internally connects the two 15-pin connectors – providing an uninterrupted signal path between them. That is, pin 1 of the DCE connector is internally connected to pin 1 of the DTE connector.

There are two basic monitoring configurations. In the first, the DB15 four-connector cable (supplied by W&G) is connected between the DTE and DCE. Depending on the distance between the DA-30 and the DTE-DCE interface being monitored, you may then connect one of the free ends of the four-connector cable to one of the LIM rear panel connectors – either directly as shown in Figure X21-5 (a) or via a DB15 extension cable (user-supplied) as shown in Figure X21-5 (b).

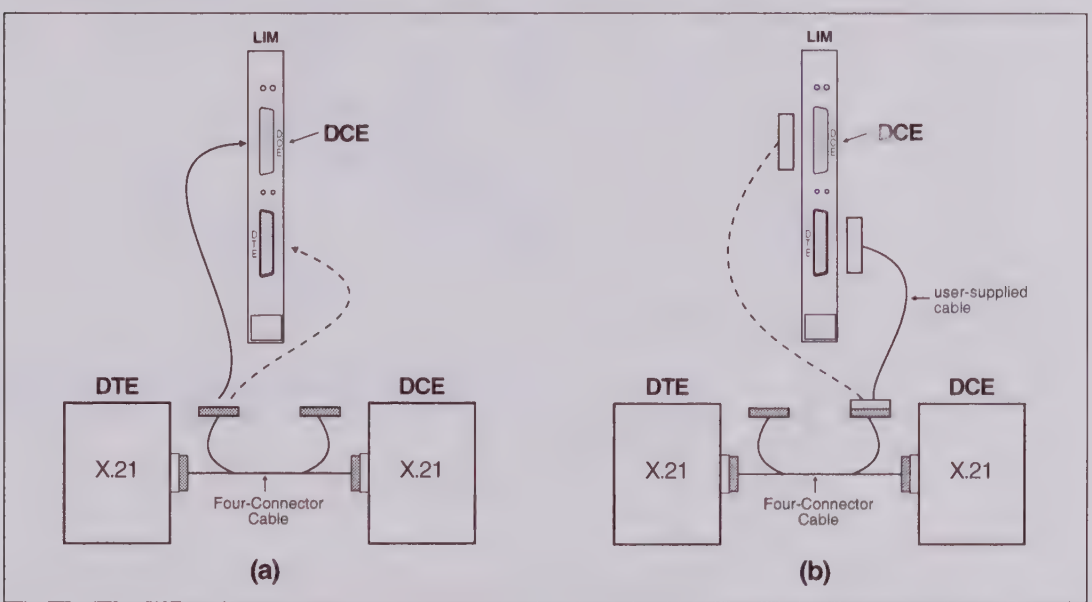


Figure X21-5 Monitoring Configuration # 1 (a) & (b)

In the second configuration, the four-connector cable is connected between the LIM's DCE connector and the DTE. Another (user-supplied) DB15 cable is connected between the LIM's DTE connector and the DCE. See Figure X21-6. These connections could also be reversed (i.e. the four-connector cable between the LIM's DTE connector and DCE, etc.).

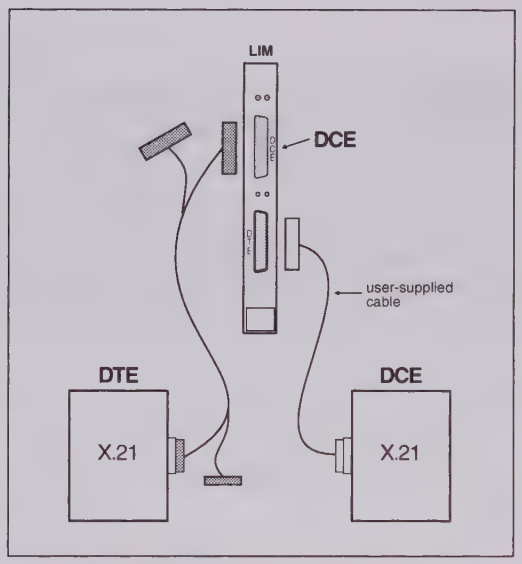


Figure X21-6 Monitoring Configuration # 2

X21.3.3. Connecting For DTE Emulation

When in the Emulate DTE mode, the LIM is used to test DCE devices. In the emulate DTE configuration, the four-connector cable is connected between the LIM's DTE connector and the DCE. See Figure X21-7.

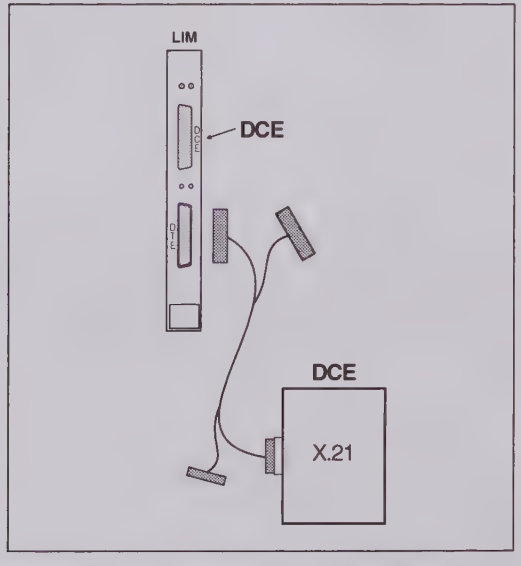


Figure X21-7 Emulate DTE Configuration

X21.3.4. Connecting For DCE Emulation

When in the Emulate DCE mode, the LIM is used to test DTE devices. In the emulate DCE configuration, the four-connector cable is connected between the LIM's DCE connector and the DTE. See Figure X21-8.

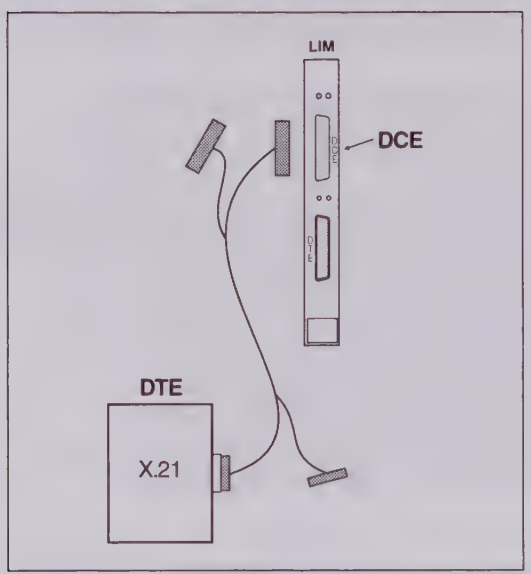


Figure X21-8 Emulate DCE Configuration

X21.4. Setting Up The Line Interface

By now, you have installed the LIM in the DA-30, installed and loaded the LIP and LPP software, and made the appropriate test connections for monitoring or emulation. You are now ready to setup the line interface for your particular test. To perform the setup, press F2 (line setup) to see the top level setup screen (X.21 Setup) shown in Figure X21-9. You may select either of the following two setup menus:

- Line Setup
- CRC Setup

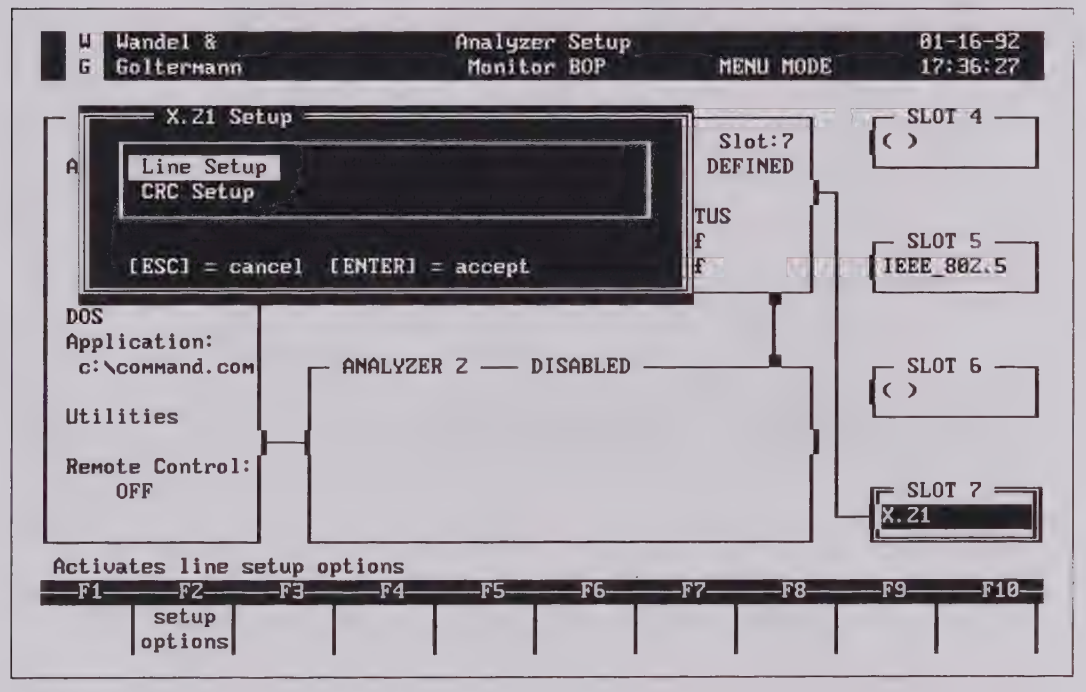


Figure X21-9 X.21 Setup Screen

X21.4.1. The Line Setup

The cursor should already be on Line Setup. Press F2 (setup options) to see the Line Setup menu shown in Figure X21-10.

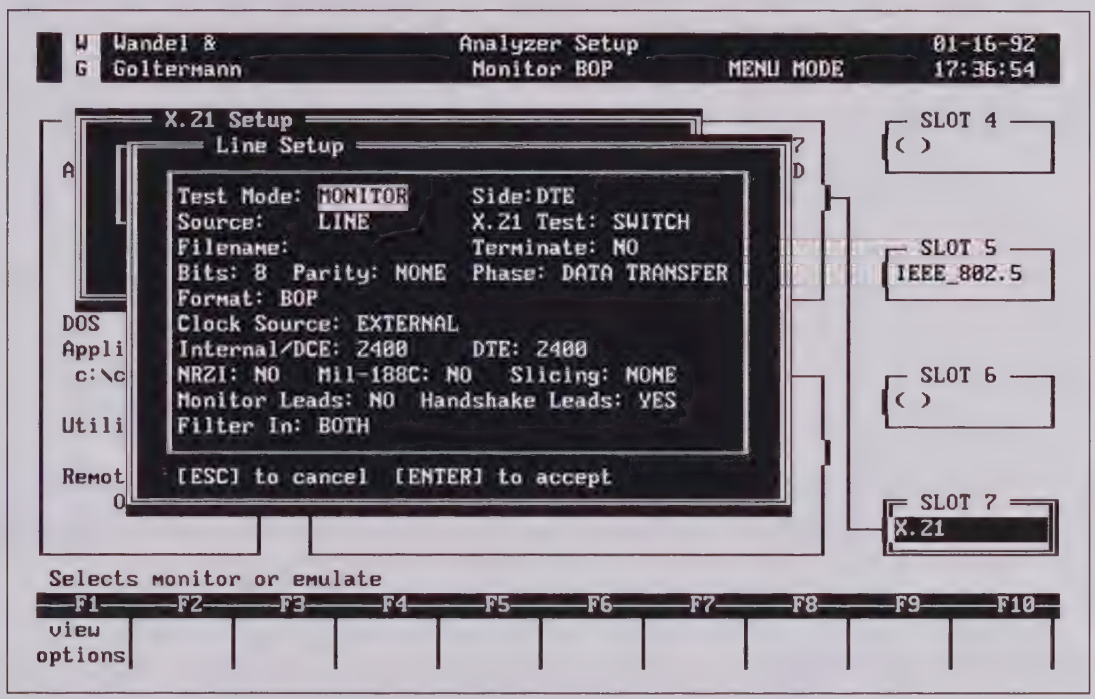


Figure X21-10 Line Setup

The Line Setup menu allows you to configure the data line parameters.

X21.4.1.1. Test Mode

This field allows you to select between two modes of operation:

- MONITOR – the DA-30 passively monitors network activity on both sides of the DTE-DCE interface. Received data is also processed according to the Network Event Program (if defined).
- EMULATE – the DA-30 transmits network data and drives the appropriate control lead – depending on the type of emulation (DTE or DCE). Received data is also processed according to the Network Event Program (if defined).

X21.4.1.2. Side

When the selected Mode is EMULATE, this field allows you to select the side of the DTE-DCE interface to Emulate.

- DTE – the DA-30 emulates a DTE device while appropriately driving the C, and X leads. This selection is used when testing DCE equipment (i.e. modem).
- DCE – the DA-30 emulates a DCE device while appropriately driving the I, S, and B leads. This selection is used when testing DTE equipment (i.e. computer, terminal, etc.).

X21.4.1.3. Source

The DA-30 is able to analyze data from two sources:

- Line – The physical network is the source of the data.
- File – A logged data file is the source of the data.

X21.4.1.4. Test

This field determines the type of device that the DA-30 monitors or emulates. The choices are:

- SWITCH
- USER
- LEASE

> **Note:**
>
> This field is currently not implemented. Any selections made here are ignored by the DA-30.

X21.4.1.5. Filename

When the Source is set to FILE, you enter the name of the logged data file. To see a list of available filenames to choose from, press F1 (view options). Use the cursor keys to highlight a filename and press Enter to load the file.

X21.4.1.6. Terminate

This field allows you to select whether or not the data lines (T and R) are to be terminated with 100 Ohm resistors. This field is used only when emulating.

- YES – The data lines are terminated with 100 Ohm resistors. If emulating a DCE, the transmit data (T) line is terminated. If emulating a DTE, the receive data line (R) is terminated.
- NO – The data lines are not terminated.

X21.4.1.7. Bits

This field allows you to select the number of bits per character. The options are:

- 8
- 7
- 6
- 5

The selections for 5, 6 and 7 bits are valid only for asynchronous transmission. Therefore, the Format field (discussed later) should be set to ASYNC. This field is checked during program compilation. If BOP or SYNC is selected for Format, an error message will be displayed.

X21.4.1.8. Parity

This field allows you to select the type of parity error detection used. The options are:

- NONE – No parity checking.
- ODD – Odd parity is used. The combined data and parity bits should contain an odd number of ones.
- EVEN – Even parity is used. The combined data and parity bits should contain an even number of ones.
- MARK – Parity bit is always binary 1.
- SPACE – Parity bit is always binary 0.

This field defaults to NONE.

Note:

NONE is the only valid selection when 8 is the selected number of bits per character.

X21.4.1.9. Phase

This field sets the initial phase (call establishment, data transfer, or clear connection) of the DA-30 upon entering Run Mode. Currently, only the DATA TRANSFER phase is supported.

X21.4.1.10. Format

This field allows you to select the data format being used by the device or system under test. Press F1 (view options) to see the following choices:

- BOP – For devices using Bit-Oriented Synchronous Protocols that use 7E-framing and zero insertion. Examples of these protocols are HDLC and SDLC.
- SYNC – For devices using Character-Oriented Synchronous Protocols. Examples of these protocols are BSC (Binary Synchronous Communications or Bisync) and DDCMP (Digital Data Communications Message Protocol).

Note:

Only ANSI Bisync is supported – not IBM Bisync.

- ASYNC – For devices using an Asynchronous transmission format.

The Format field defaults to BOP. Move the cursor to the desired data format and press Enter to make your selection. Configuration screens for each of the above data formats can be accessed from the Format softkey rack by pressing either F3 (bop setup), F4 (sync setup), or F5 (async setup). See Figure X21-11.

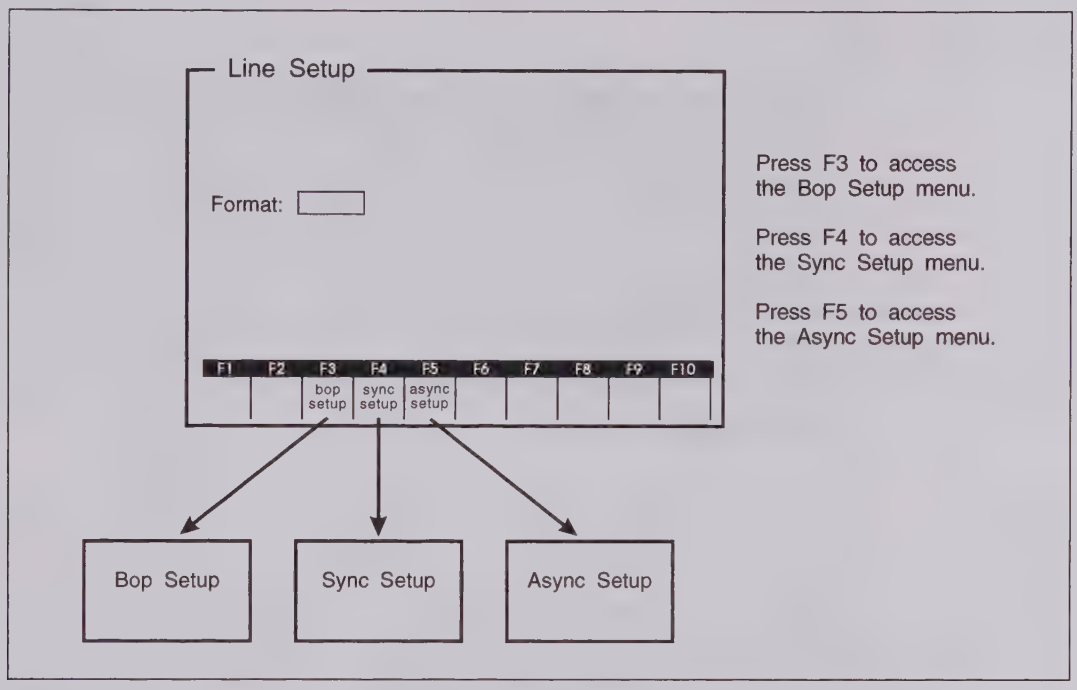

Line Setup
Format:
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
bop setup
sync setup
async setup
Press F3 to access the Bop Setup menu.
Press F4 to access the Sync Setup menu.
Press F5 to access the Async Setup menu.
Bop Setup
Sync Setup
Async Setup

Figure X21-11 Accessing Data Format Configuration Screen

X21.4.1.10.1. Bop Setup

Press F3 (bop setup) to change the default Bop settings shown in Figure X21-12.

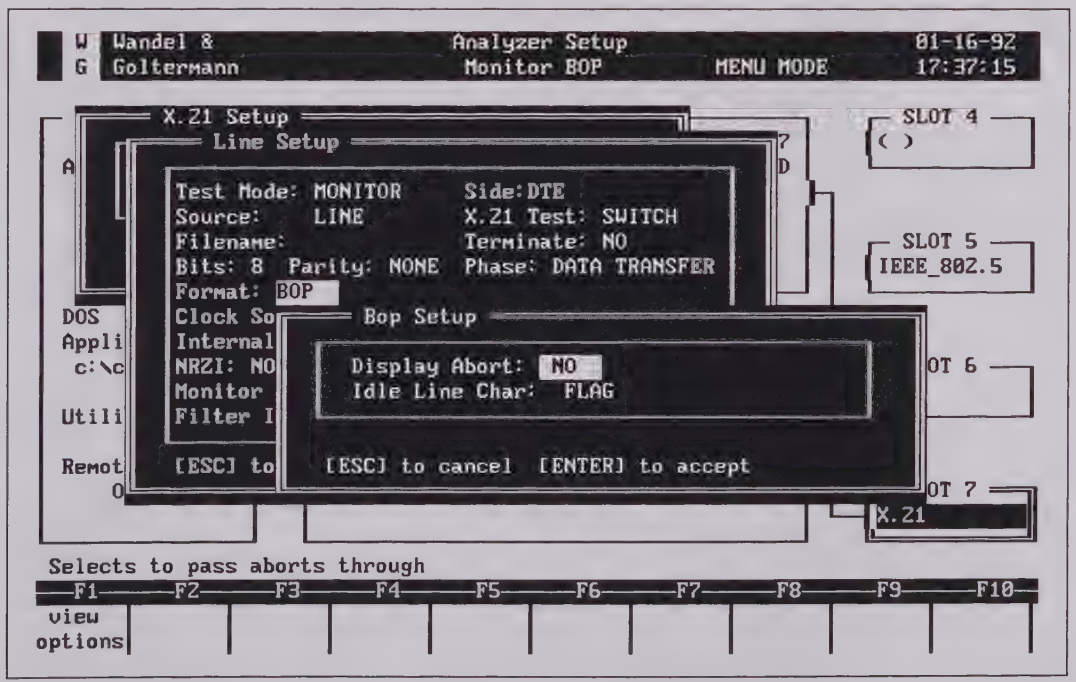


Figure X21-12 Bop Setup

X21.4.1.10.1.1 Display Abort

This field allows you to select whether or not Aborted frames trigger a specific event in the Network Event Program.

- NO
- YES

This field defaults to NO.

X21.4.1.10.1.2 Idle Line Character

This field allows you to select the character that the receiver interprets as an idle line (no data being transmitted).

- FLAG – Sets the Idle Line Character to 7E (hex).
- MARK – Sets the Idle Line Character to FF (hex).

The default Idle Line Character is FLAG (7E).

X21.4.1.10.2. Sync Setup

Press F4 (sync setup) to change the default Sync settings shown in Figure X21-13.

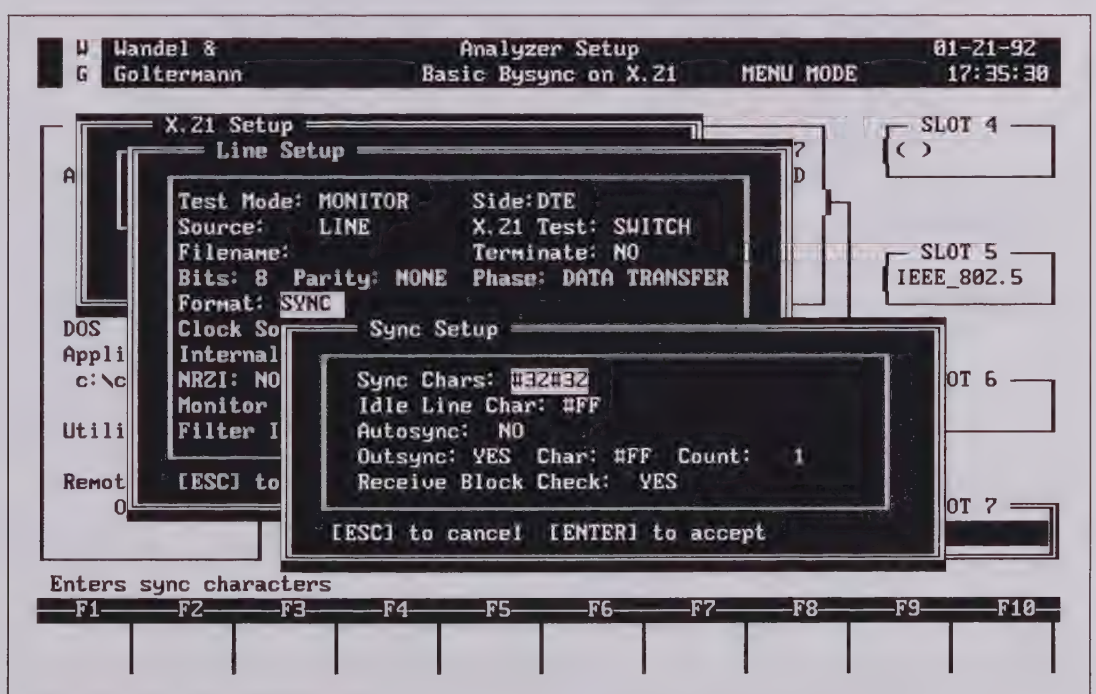


Figure X21-13 SYNC Setup

X21.4.1.10.2.1 Sync Characters

This field allows you to enter the hexadecimal characters the receiver uses to synchronize itself with the beginning of a frame. The format for this entry is:

#xx#xx where: # represents hexadecimal notation
xx is the character value

The default Synch Characters are #32#32.

X21.4.1.10.2.2 Idle Line Character

This field allow you to enter the Idle Line Character that is transmitted. This field is valid only when the Test Mode is set to Emulate. The format for this entry is:

#xx where: # represents hexadecimal notation;
xx is the character value

The default Idle Line Character is #FF.

X21.4.1.10.2.3 Autosync

This field allows you to select whether or not the receivers resynchronize each time the sync characters are detected.

- NO – The sync characters cause re-synchronization only if the receiver is out of sync.
- YES – Every occurrence of the sync characters causes re-synchronization.

This field defaults to NO.

X21.4.1.10.2.4 Outsync

This field allows you to select whether or not the receiver goes out of sync when it detects the Outsync character pattern.

- NO
- YES

This field defaults to YES.

X21.4.1.10.2.5 Character

This field allows you to select the character that the receiver interprets as the Outsync Character. The format is:

#xx where: # represents hexadecimal notation;
xx is the character value

The default Outsync Character is #FF.

X21.4.1.10.2.6 Count

This field determines the consecutive number of times the Outsync Character must be detected before the Outsync condition takes effect. The count can range from 1 to 999.

The default Outsync Count is 1.

X21.4.1.10.2.7 Receive Block Check

This field determines if CRC (Cyclic Redundancy Check) error detection is performed.

- NO – No CRC calculation is performed.
- YES – The receiver performs a CRC calculation according to the CRC Setup menu.

This field defaults to YES.

X21.4.1.10.3. Async Setup

Press F5 (async setup) to change the default Async settings. The Async Setup window is shown in Figure X21-14.

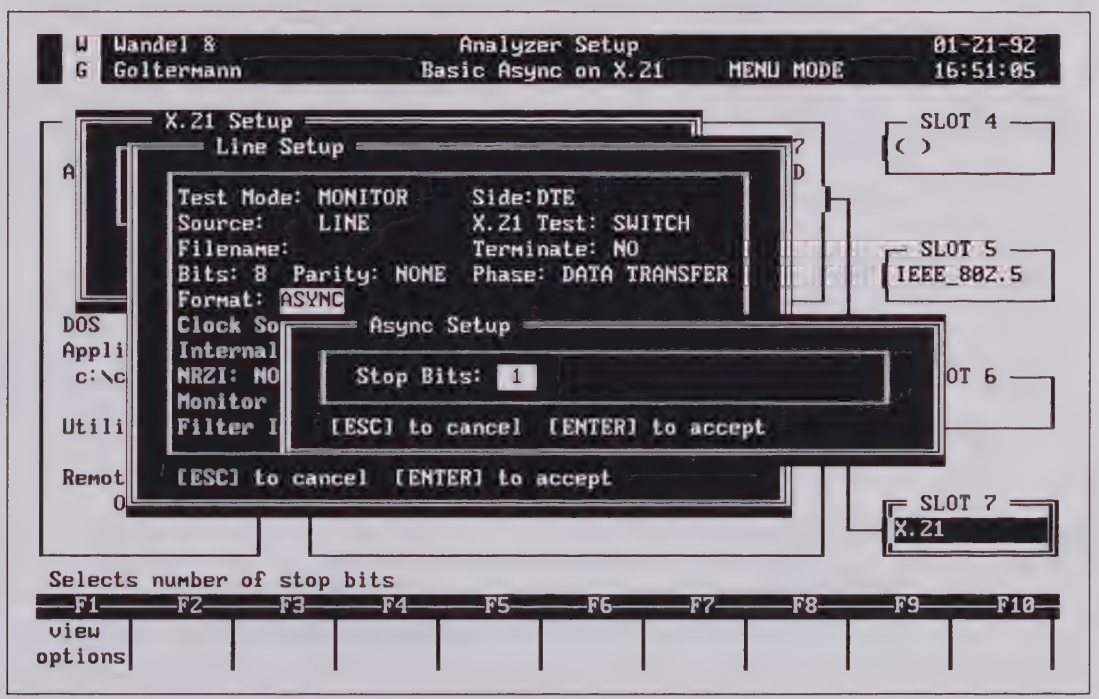


Figure X21-14 ASYNC Setup

X21.4.1.10.3.1 Stop Bits

This field allows you to select the minimum number of stop bits that terminate each data character. A stop bit is defined as a binary 1. The following choices are provided:

- 1 – Appends at least 1 stop bit at the end of each character.
- 2 – Appends at least 2 stop bits at the end of each character.

The default number of Stop Bits is 1.

The Stop Bits field, along with your selections for Bits and Parity, complete the asynchronous transmission setup. See Figure X21-15.

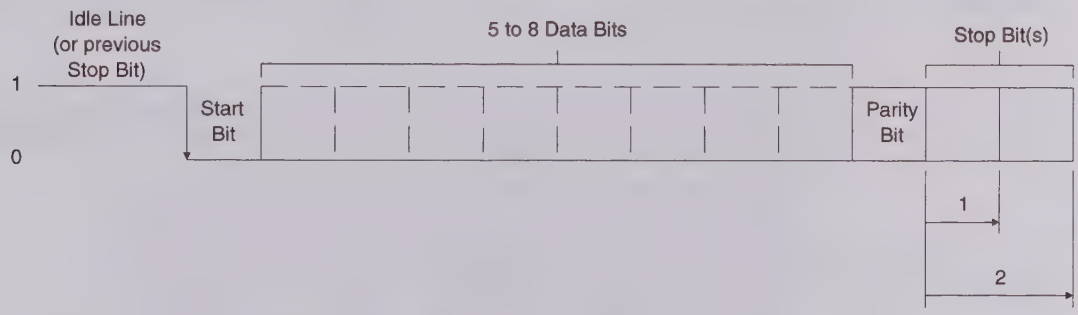


Figure X21-15 Asynchronous Transmission Format

The "Idle Line" state is also defined as a binary 1. When the transmitter is ready to send a character, it will send a start bit (binary 0) followed by the character (5 to 8 bits). It will then send a parity bit (if specified) and terminate transmission with the specified number of stop bits.

X21.4.1.11. Clock Source

- EXTERNAL – This setting is used when the DA-30 acts as a monitor between a DTE and a DCE – with the DA-30 clock being supplied by the DTE, DCE, or some other source.
- INTERNAL – This setting is used when the DA-30 is emulating a DTE or DCE.

  This setting must be used whenever using the ASYNC data format. ASYNC means there is no clock on the interface leads and the DA-30 will not look for an external clock.
- INTERNAL SPLIT – This setting is used when you are monitoring or emulating a DCE in an asynchronous system where different baud rates are used for receive and transmit data. This setting can also be used when emulating a DCE on dual-speed, synchronous lines.

X21.4.1.12. Internal/DCE

This field allows you to enter the data line speed (in bits/sec) when the Test Mode is set to EMULATE.

- If the selected Clock Source is INTERNAL, this field is used to set the speed for both the DTE and DCE side of the interface.
- If the selected Clock Source is INTERNAL SPLIT, this field is used to set the speed for the DCE side of the interface. This field defaults to 2400 and is used only when emulating a DCE.

X21.4.1.13. DTE

This field allows you to enter the data line speed (in bits/sec) when the selected Mode is EMULATE.

- If the selected Clock Source is INTERNAL SPLIT, this rate is used only for the DTE side of the data line. It is otherwise unused. This field defaults to 2400.

X21.4.1.14. NRZI – Non Return to Zero Inverted

This field allows you to select whether or not Non Return to Zero Inverted data encoding is performed.

- NO
- YES

In the NRZI encoding scheme, the line polarity is inverted with the transmission of each binary 0. The line polarity does not change, however, with the transmission of a binary 1. See Figure X21-16.

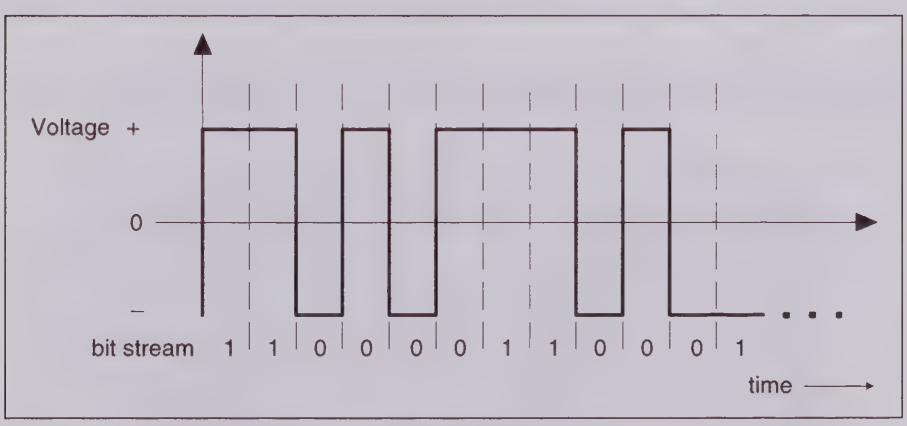


Figure X21-16 NRZI Encoding Example

This field defaults to NO.

X21.4.1.15. Mil-188C

This field allows you to select whether or not to invert the data signals (TD and RD).

- NO
- YES

This field defaults to NO.

X21.4.1.16. Slicing

Frame Slicing allows you to shorten a data frame before it is passed to the protocol analyzer for processing. This is useful when you are only interested in certain parts of a frame (i.e frame headers). Frame slicing is not valid when using the ASYNC data format.

- NONE – The entire frame is passed.
- 32 – Only the first 32 bytes of a frame are passed.

- 64 – Only the first 64 bytes of a frame are passed.
- 128 – Only the first 128 bytes of a frame are passed.
- 256 – Only the first 256 bytes of a frame are passed.
- 512 – Only the first 512 bytes of a frame are passed.
- 1024 – Only the first 1024 bytes of a frame are passed.

Frame slicing also allows you to maximize the amount of protocol information that is written to the capture buffer or to the hard disk (when logging). Although no data beyond the specified size is passed to the protocol analyzer, CRC checking is performed for the entire frame.

Note:

Be careful not to slice a frame in the middle of a protocol header – making the protocol invalid for decoding.

This field defaults to NONE.

X21.4.1.17. Monitor Leads

This field allows you to monitor the activity of the data and control leads (T, C, I & R). During Run Mode, the waveform for each lead is displayed on the Network Status screen.

- NO – The control leads are not monitored.
- YES – The control leads are monitored.

This field defaults to NO.

X21.4.1.18. Handshake Leads

This field allows you to select whether or not control lead handshaking is to be performed when the selected Test Mode is EMULATE.

- NO – No control lead handshaking is performed during data transmission.
- YES – Control lead handshaking is performed.

This field defaults to YES.

Note:

This field is currently not implemented. Any selections made here are ignored by the DA-30.

X21.4.1.19. Filter In

The received data that is processed by the analyzer can come from either or both sides of the interface. This field allows you to make that selection. Press F1 (view options) for the following choices:

- BOTH – Signals from both the DTE and the DCE sides of the interface are passed to the analyzer for processing.
- DTE – Only signals from the DTE side of the interface are passed up to the analyzer for processing.
- DCE – Only signals from the DCE side of the interface are passed up to the analyzer for processing.

This field defaults to BOTH.

X21.4.2. CRC (Cyclical Redundancy Check) Setup

From the Top Level setup screen, move the cursor to CRC Setup and press F2 (crc options) to see the CRC Setup screen shown in Figure X21-17.

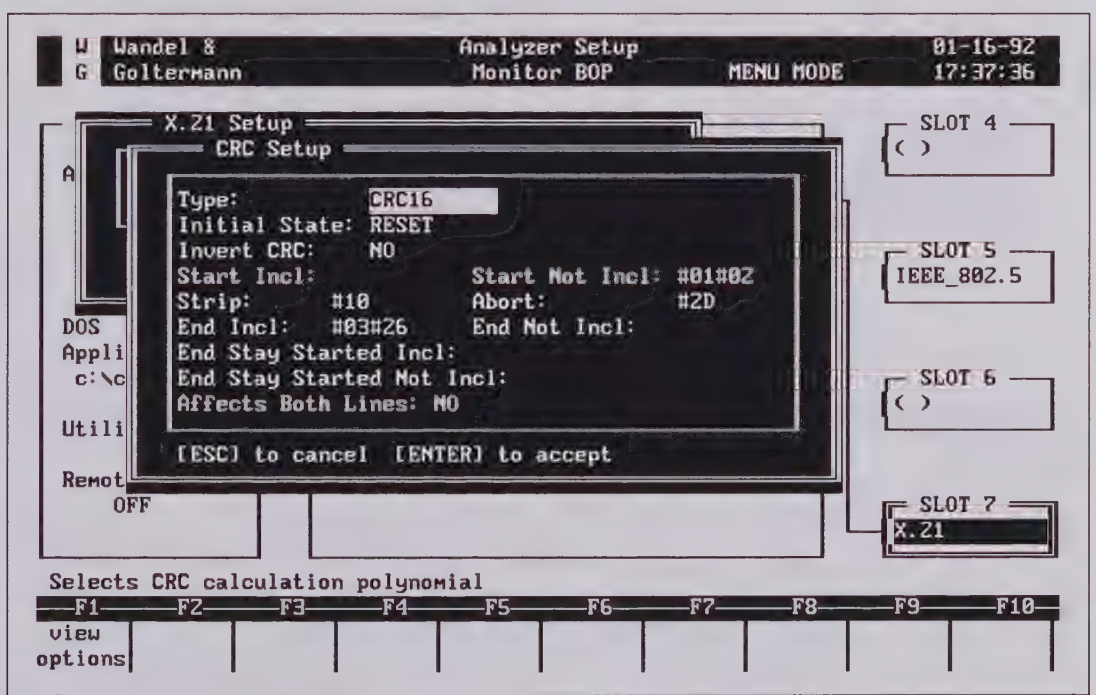


Figure X21-17 CRC Setup

The CRC calculator has a Start state and an Accumulate state. In the Start state, the calculator waits for the character that starts the calculation. In the Accumulate state, the calculator performs the calculation according to the CRC polynomial.

The calculator changes from the Start state to the Accumulate state on the first Start character it detects. Subsequent Start characters that are detected – once in the Accumulate state – are treated as normal characters in the data stream. When an End character is detected, the calculation stops, and the CRC calculator compares its calculation to the frame's transmitted FCS value. Based on this comparison, the frame is then evaluated as Good or Bad. The calculator then returns to the Start state.

The CRC calculator is used for the ANSI Bisync protocol only. Therefore, the CRC Setup screen defaults to an ANSI Bisync CRC check. So, when using the CRC calculator, be sure to set Format to SYNC on the Line Setup menu.

The ANSI Bisync default settings and their explanations are shown in Table 2.

FIELD	DEFAULT	EXPLANATION
Type	CRC16	The $x^{16} + x^{15} + x^2 + 1$ polynomial is used.
Initial State	RESET	The CRC is initially set to all zeros.
Invert CRC	NO	The polarity of the CRC is unchanged.
Start Incl	Blank	N/A
Start Not Incl	#01#02 (See Note)	The occurrence of **either** of these characters (01 or 02) in the data stream triggers the CRC calculation on the received frame. They are not included in the CRC calculation.
Strip	#10 (See Note)	This character is excluded (Stripped) from the CRC calculation.
Abort	#2D (See Note)	This character causes the CRC calculator to abort the current calculation. The current frame is then flagged as an aborted frame, and the calculator returns to the Start state.
End Incl	#03#26 (See Note)	The occurrence of **either** of these characters (03 or 26) in the data stream triggers the end of the CRC calculation. These characters are included in the CRC calculation. The CRC calculator then compares its calculation to the frame's FCS value. Based on this comparison, the frame is then evaluated as Good or Bad, and the calculator returns to the Start state.
End Not Incl	Blank	N/A
End Stay Started Incl	Blank	N/A
End Stay Started Not Incl	Blank	N/A
Affects Both Lines	NO	When an Abort character is detected, the CRC calculation aborts only the side (DTE or DCE) of the data line that generated the Abort.

Note: # denotes hexadecimal notation.

Table 2 Default CRC Settings

X21.5. TESTPREP Consistency Check

After you have the completed the interface setup (Line Setup and CRC Setup) and returned to the Main menu, you can run your current application by going to the Run Mode (press the Alt-Run keys). Before going from the Menu Mode to the Run Mode, the DA-30 runs a program called TESTPREP that checks to see if all your setup entries are consistent before compiling and running your application. If you have inadvertently created an inconsistent setup, TESTPREP flags the problem. A warning message will appear offering you the option of returning to Menu Mode to correct the inconsistent settings or allowing the DA-30 to change them for you. See Figure X21-18. If you choose the latter, the change takes effect in Run Mode only; that is, the menu selection is not physically altered. Running the application again without making the necessary correction(s) in the setup menus produces the same results. Therefore, upon seeing the warning message, you may wish to return to Menu Mode, correct the inconsistency, and save the application before running again.

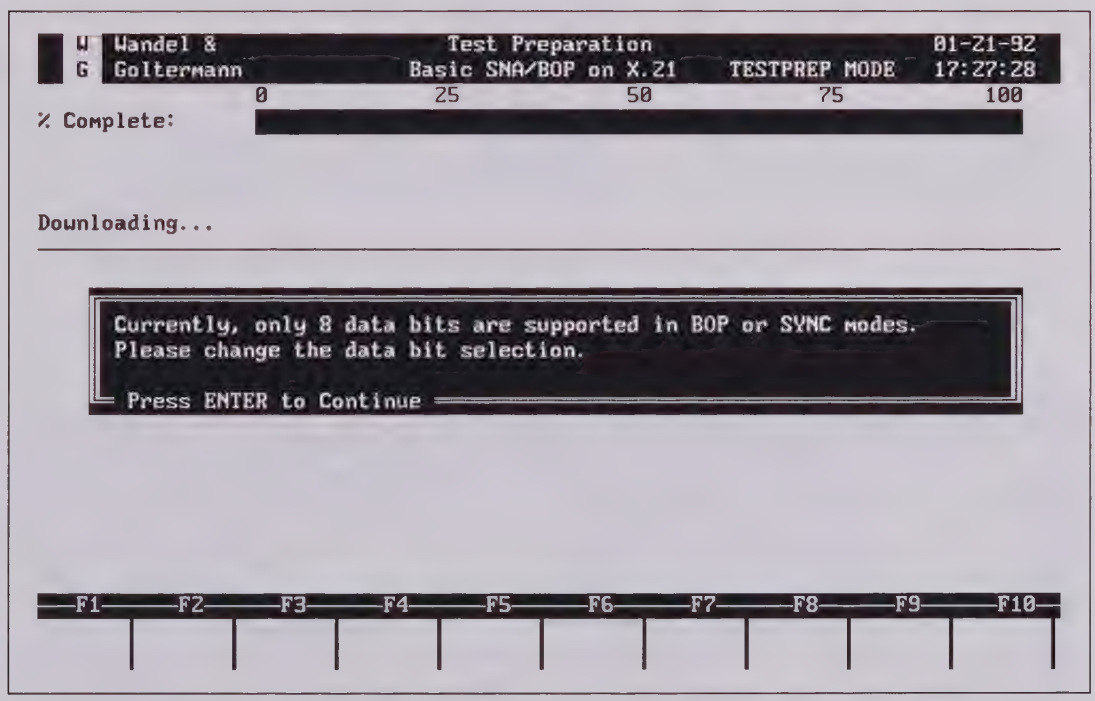


Figure X21-18 TESTPREP Warning

X21.6. Front Panel LEDs

There are 9 front panel LEDs. Seven of these indicate the status of a corresponding set of pins (interchange circuit) on the X.21 interface. Two other LEDs (DTE MON & DCE MON) are provided to indicate the test mode of the LIM. An LED overlay is used to associate each LED with a particular interface circuit. See Figure X21-19.

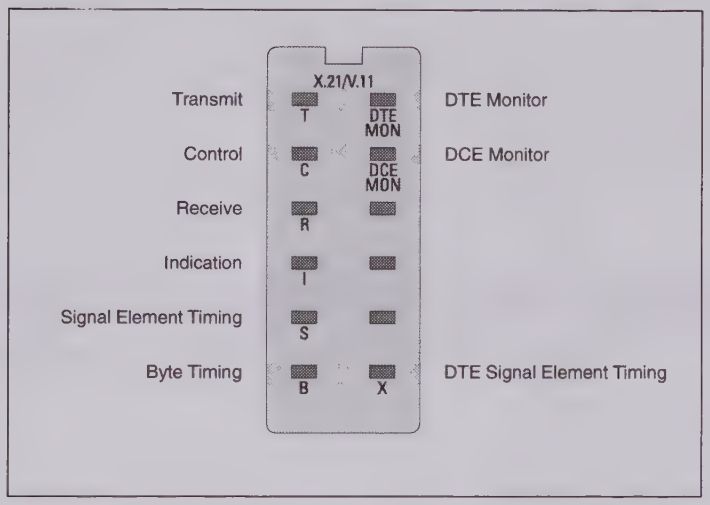


Figure X21-19 LED Overlay (with Labels)

Underneath each LED, there is a standard circuit abbreviation.

The status of the individual interface lines is indicated by the color of their respective LEDs. If no signal is present on a line, or if the signal floats between binary 1 and binary 0, the corresponding LED will be OFF. If a pin is driven HIGH (binary 0), its LED will be RED. If a line is driven LOW (binary 1), its LED will be GREEN. If a line is rapidly alternating between binary 1 and binary 0, its LED will be ORANGE (steady or flickering). See Table 3.

Interface Signal	LED Status	
	RED	GREEN
T	Binary 0 (SPACE)	Binary 1 (MARK)
C	ON	OFF
R	Binary 0 (SPACE)	Binary 1 (MARK)
I	ON	OFF
S	ON	OFF
B	ON	OFF
DTE MON	Emulate DTE	Monitor Mode
DCE MON	Emulate DCE	Monitor Mode
X	X Timing Mode	B Timing Mode

Table 3 Front Panel LED Color Indication

The LED that is labelled X is used to indicate when X signal timing (from DTE) is being used instead of the normal signal element timing (S).

X21.7. Viewing Results in Run Mode

The X.21 Line Interface software (LIP) offers two basic screens for displaying results in the Run Mode. These are the Network Status and Character Trace screens. Either of these screens may be displayed automatically upon entering the Run Mode by selecting it for the initial Run Mode display. This is described in the Initial Displays section of the "Applications" chapter in the *DA-30/31 Operating Manual*.

If higher-layer protocol packages are loaded and active in the current application, you can also access the Protocol Trace screens by pressing F3 (protocol traces) from the Run Mode Top Rack.

X21.7.1. Network Status Screen

To access the Network Status screen, press F1 (NETWORK STATUS) from the Run Mode Top Rack. The Network Status screen that appears when using synchronous data formats (BOP or SYNC) differs from the one that appears when using asynchronous data formats (ASYNC).

When Using BOP or SYNC:

The Network Status screen that appears when using the BOP or SYNC data format is shown in Figure X21-20.

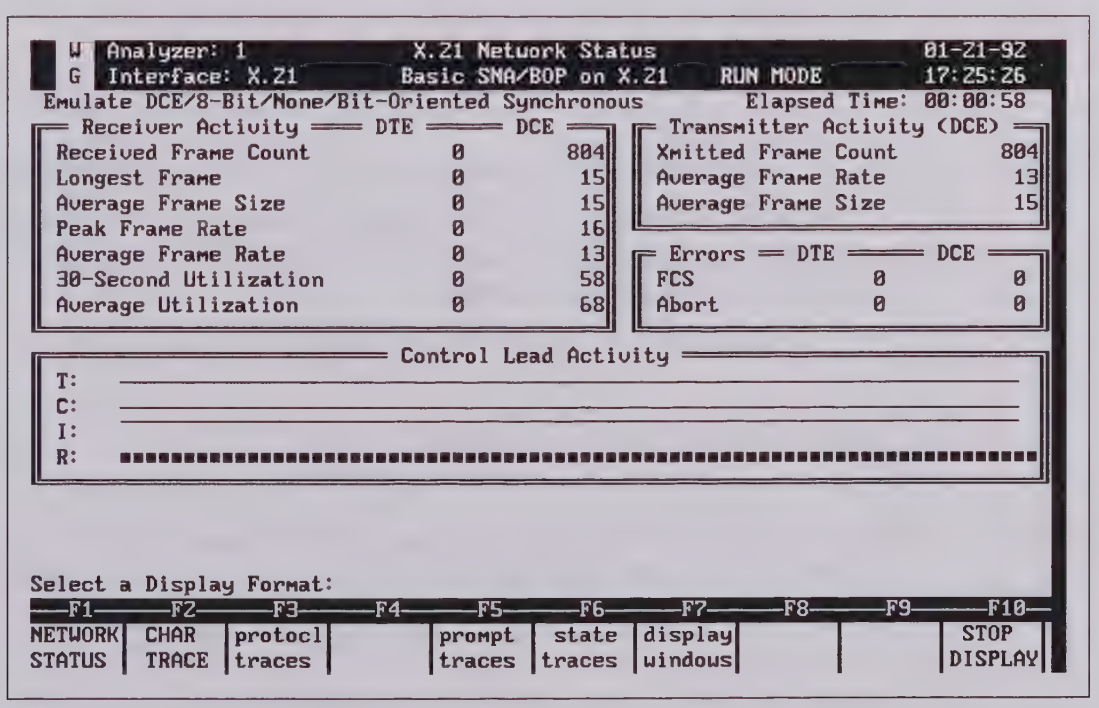


Figure X21-20 RUN MODE Network Status Screen (BOP or SYNC)

The first line of this screen summarizes the Line Setup settings. The current Test Mode, number of Bits per character, type of Parity used (if any), and the Format (transmission technique) used for the data are all listed as follows:

Test Mode/Bits/Parity/Format

The first line also contains an Elapsed Time counter that reports the time that elapsed since the current application started running. The rest of the screen is subdivided into four sections that detail the Receiver Activity, Transmitter Activity, Errors and Control Lead Activity.

X21.7.1.1. Receiver (or Playback) Activity

The name of this section depends on the Source selection on the Line Setup menu. If the data being analyzed comes from the Line, this section is labelled Receiver Activity. If the data comes from a logged data file, this section is labelled Playback Activity.

Note:

Because the log file structures for BOP, SYNC and ASYNC data formats are unique, only playback log files using the data format in which they were created. Otherwise, you may get unpredictable results.

This section is further partitioned into two columns. One for the DTE side of the interface and one for the DCE side. For each side of the interface, the following information is reported:

- Received Frame Count – the current number of frames received.
- Longest Frame – the size (in bytes) of the longest frame that has been received since receiving began.
- Average Frame Size – the current average size (in bytes) of the received frames since receiving began.
- Peak Frame Rate – the highest frame rate (Frames per second) detected at the receiver.
- Average Frame Rate – the current average frame rate (Frames per second).
- 30-Second Utilization – the average utilization (%) for the past 30-second interval. This field is updated every 30 seconds.
- Average Utilization – the average utilization (%) since receiving began.

Note:

Currently, the 30-Second Utilization and Average Utilization fields are supported only when the Clock Source is set to Internal. Otherwise, these fields will display “Unavail”.

X21.7.1.2. Transmitter Activity ( )

Depending on the Test Mode, the area inside the parentheses, ( ), will contain one of the following designations:

MON. When MONITOR is the selected Test Mode.

DTE. When EMULATE is the selected Test Mode and DTE is the selected Side.

DCE. When EMULATE is the selected Test Mode and DCE is the selected Side.

Whether emulating a DTE or DCE, this section reports the following information:

- Transmitted Frame Count – the current number of frames that have been transmitted.
- Average Frame Rate – the current average rate (Frames per second) at which frames are being transmitted.
- Average Frame Size – the current average size (in bytes) of the transmitted frames since transmission began.

X21.7.1.3. Errors

This section is also partitioned into a DTE column and a DCE column. For each side of the interface, the following counters report the number of errors detected by the receiver:

- FCS – this counter is incremented each time a Frame Check Sequence (CRC) error occurs.
- Break – this counter is incremented each time a Break or Abort occurs. Depending on the data format being used, the counter value represents the number of Breaks or Aborts that have occurred. See Table 4.

Error Type	Data Format	Error Condition
Abort	BOP	Seven consecutive ones occurs in data stream.
Abort	SYNC	The specified Abort character appears in the data stream when the Block Check is calculated. -or- The receiver goes out of sync – due to the Outsync character being detected for the specified number (Outsync Count) of times.
Break	ASYNC	Consecutive zeros occurring for Start, Data, & optional Parity bits.

Table 4 Type of Errors Represented by the Break Counter

X21.7.1.4. Control Lead Activity

This section of the screen graphically displays the waveforms for the data and control leads (T, C, I and R). This allows you to examine their timing relationships. Data and control activity is indicated on the T and R lines by a fill-in character (▮). An underscore (_) represents inactivity.

This section of the screen is enabled only when YES is selected for Monitor Leads on the Line Setup menu. It is otherwise left blank. It is also blank whenever playing back data from a logged file.

When Using ASYNC:

When using asynchronous data formats, the Network Status screen appears as shown in Figure X21-21.

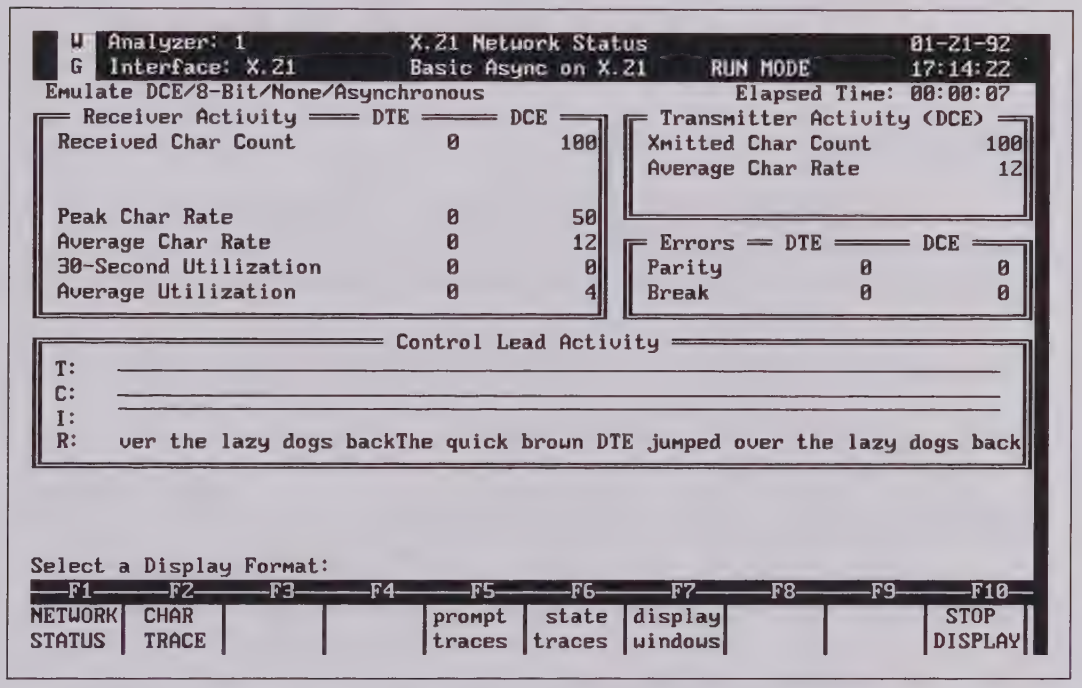

W Analyzer: 1 X.21 Network Status 01-21-92
G Interface: X.21 Basic Async on X.21 RUN MODE 17:14:22
Emulate DCE/8-Bit/None/Asynchronous Elapsed Time: 00:00:07
Receiver Activity DTE DCE
Received Char Count 0 100
Peak Char Rate 0 50
Average Char Rate 0 12
30-Second Utilization 0 0
Average Utilization 0 4
Transmitter Activity (DCE)
Xmitted Char Count 100
Average Char Rate 12
Errors DTE DCE
Parity 0 0
Break 0 0
Control Lead Activity
T:
C:
I:
R: ver the lazy dogs backThe quick broun DTE jumped over the lazy dogs back
Select a Display Format:
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
NETWORK STATUS
CHAR TRACE
prompt traces
state traces
display windows
STOP DISPLAY

Figure X21-21 RUN MODE Network Status Screen (ASYNC)

Since the basic unit of asynchronous transmission is the character , the word “Frame” is replaced by “Char” in all of the fields in the Receiver Activity and Transmitter Activity sections of the screen. Moreover, those fields that have only to do with frames have been removed (i.e. Longest Frame, Average Frame Size).

Instead of using the fill-in character to represent data activity, in the Control Lead Activity section, the T and R lines show the actual characters being transmitted/received.

X21.7.2. Character Trace Screen

To access the Character Trace screen, press F2 (CHAR TRACE) from the Run Mode Top Rack. The Character Trace screen that appears when using synchronous data formats (BOP or SYNC) differs from the one that appears when using asynchronous data formats (ASYNC).

When Using BOP or SYNC:

The Character Trace screen that appears when using the BOP or SYNC format is shown in Figure X21-22.

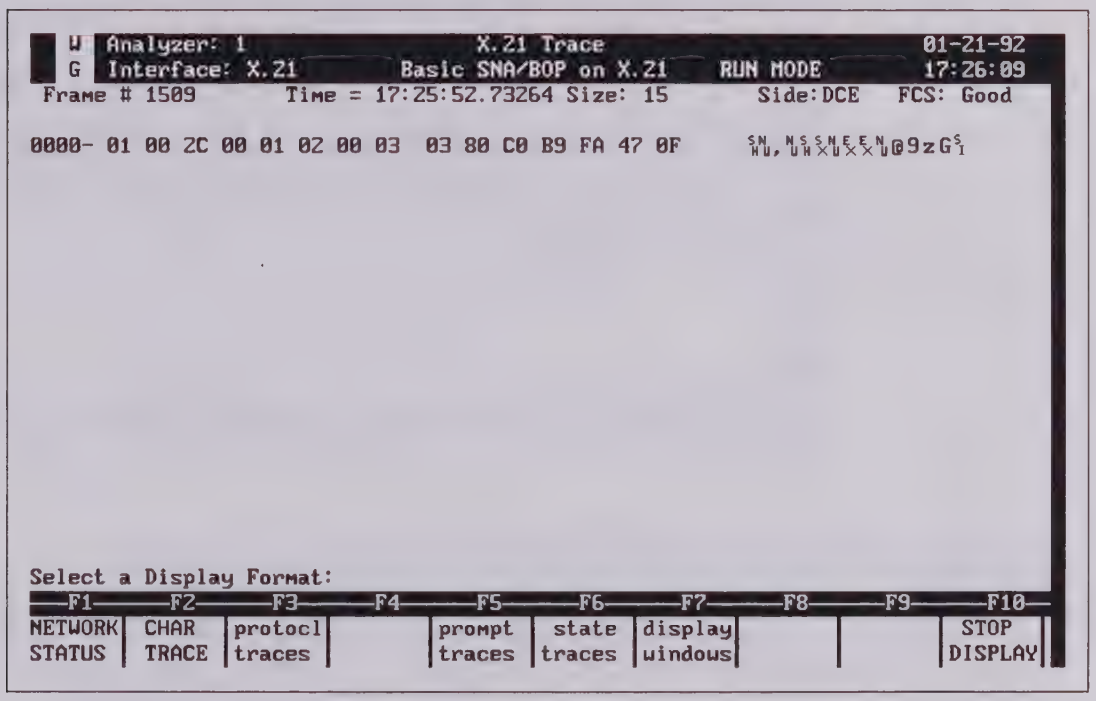

W Analyzer: 1 X.21 Trace 01-21-92
G Interface: X.21 Basic SNA/BOP on X.21 RUN MODE 17:26:09
Frame # 1509 Time = 17:25:52.73264 Size: 15 Side:DCE FCS: Good
0000- 01 00 2C 00 01 02 00 03 03 80 C0 B9 FA 47 0F
Select a Display Format:
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
NETWORK STATUS
CHAR TRACE
protocl traces
prompt traces
state traces
display windows
STOP DISPLAY

Figure X21-22 RUN MODE Character Trace Screen (BOP or SYNC)

For each frame that is received, the first line of this screen shows the number of the frame, the time it was received, its size (in bytes), the side of the line that is being monitored, and the result of the FCS (CRC) evaluation. The rest of the screen displays the frame data in hexadecimal representation (on left) and in the character representation (on right). The character code used depends on the Character Code setting on the Display Setup menu – accessed via the analyzer window's Initial Display field.

When Using ASYNC:

The Character Trace screen that appears when using the ASYNC data format is shown in Figure X21-23.

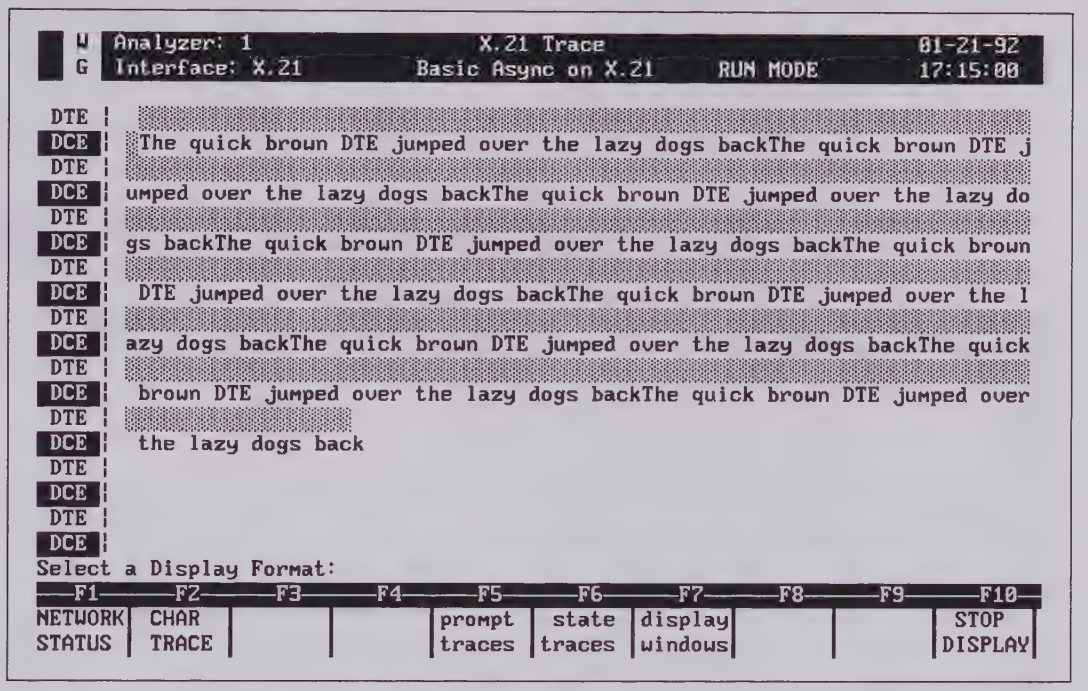

W Analyzer: 1 X.21 Trace 01-21-92
G Interface: X.21 Basic Async on X.21 RUN MODE 17:15:00
DTE
DCE The quick broun DTE jumped over the lazy dogs backThe quick broun DTE j
DTE
DCE umped over the lazy dogs backThe quick brown DTE jumped over the lazy do
DTE
DCE gs backThe quick broun DTE jumped over the lazy dogs backThe quick brown
DTE
DCE DTE jumped over the lazy dogs backThe quick brown DTE jumped over the l
DTE
DCE azy dogs backThe quick brown DTE jumped over the lazy dogs backThe quick
DTE
DCE brown DTE jumped over the lazy dogs backThe quick brown DTE jumped over
DTE
DCE the lazy dogs back
DTE
DCE
DTE
DCE
Select a Display Format:
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
NETWORK STATUS
CHAR TRACE
prompt traces
state traces
display windows
STOP DISPLAY

Figure X21-23 RUN MODE Character Trace Screen (ASYNC)

This screen displays character data in a Data Line Monitor format. Each line of the display alternates between the DTE and the DCE. Each line is appropriately labelled DTE or DCE. Moreover, the word DCE is highlighted to help distinguish DTE data from DCE data.

X21.8. Viewing Results in the Examine Mode

The X.21 Line Interface software offers the same two basic screens for examining a capture file in the Examine Mode as those described in the Run mode. Either of these screens may be displayed automatically upon entering the Examine Mode by selecting it for the initial Examine Mode display. This is described in the Initial Displays section of the "Applications" chapter in the *DA-30/31 Operating Manual*.

Note:

Because the data framing for BOP, SYNC and ASYNC are unique, you should only Examine capture files using the data format in which they were created. Otherwise, you may get unpredictable results.

X21.8.1. Network Status Screen

To access the Network Status screen, press F1 (NETWORK STATUS) from the Examine Mode Top Rack. This screen is identical to the Run Mode Network Status screen for each of the data formats (BOP, SYNC and ASYNC).

X21.8.2. Character Trace Screen

The Character Trace screen that appears when using synchronous data formats (BOP or SYNC) differs from the one that appears when using asynchronous data formats (ASYNC).

When Using BOP or SYNC:

When using the BOP or SYNC data format, the Character Trace screen looks just like the one described in Run Mode. If there are higher-level protocol packages loaded and running, you can display their traces by pressing F3 (protocol traces) from the Exam Mode Top Rack. You can then selectively display frames based on multiple (core & protocol-specific) criteria by pressing F8 (display filters). You can also access the Frame Detail screen by pressing F9 (FRAME DETAIL) from the protocol traces softkey rack. The core find commands, as well as any other protocol-specific find commands, are available by pressing F10 (find command) from either the character or protocol trace softkey rack.

When Using ASYNC:

When using the ASYNC data format, the Character Trace that appears is shown in Figure X21-24.

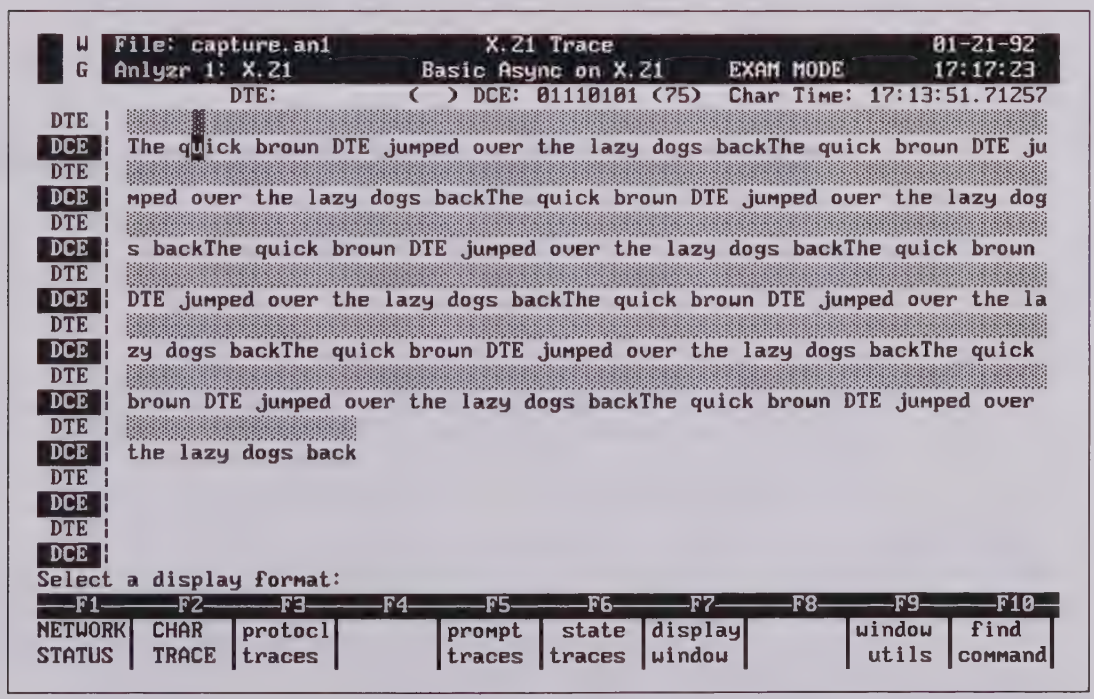

W File: capture.anl X.21 Trace 01-21-92
G Anlyzr 1: X.21 Basic Async on X.21 EXAM MODE 17:17:23
DTE: ( ) DCE: 01110101 (75) Char Time: 17:13:51.71257
DTE
DCE The quick brown DTE jumped over the lazy dogs backThe quick brown DTE ju
DTE
DCE mped over the lazy dogs backThe quick brown DTE jumped over the lazy dog
DTE
DCE s backThe quick brown DTE jumped over the lazy dogs backThe quick brown
DTE
DCE DTE jumped over the lazy dogs backThe quick brown DTE jumped over the la
DTE
DCE zy dogs backThe quick brown DTE jumped over the lazy dogs backThe quick
DTE
DCE brown DTE jumped over the lazy dogs backThe quick brown DTE jumped over
DTE
DCE the lazy dogs back
DTE
DCE
DTE
DCE
Select a display format:
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
NETWORK STATUS
CHAR TRACE
protocl traces
prompt traces
state traces
display window
window utils
find command

Figure X21-24 EXAM MODE Character Trace Screen (ASYNC)

This screen is identical to the Character Trace described for the Run Mode except for the first line. Displayed on the first line of this screen is the binary and hexadecimal representations of the characters located at the cursor position. The cursor highlights two character time slots at a time – one for the DTE and one for the DCE.

Note:

The Character Trace for ASYNC is available only if the X.21 LIP was loaded when the capture file was created.

No display filters or find commands (core or protocol-specific) are available for capture files created while using the ASYNC data format. Moreover, Frame Detail is not allowed. If the Frame Detail softkey is pressed, the error message shown in Figure X21-25 will be displayed.

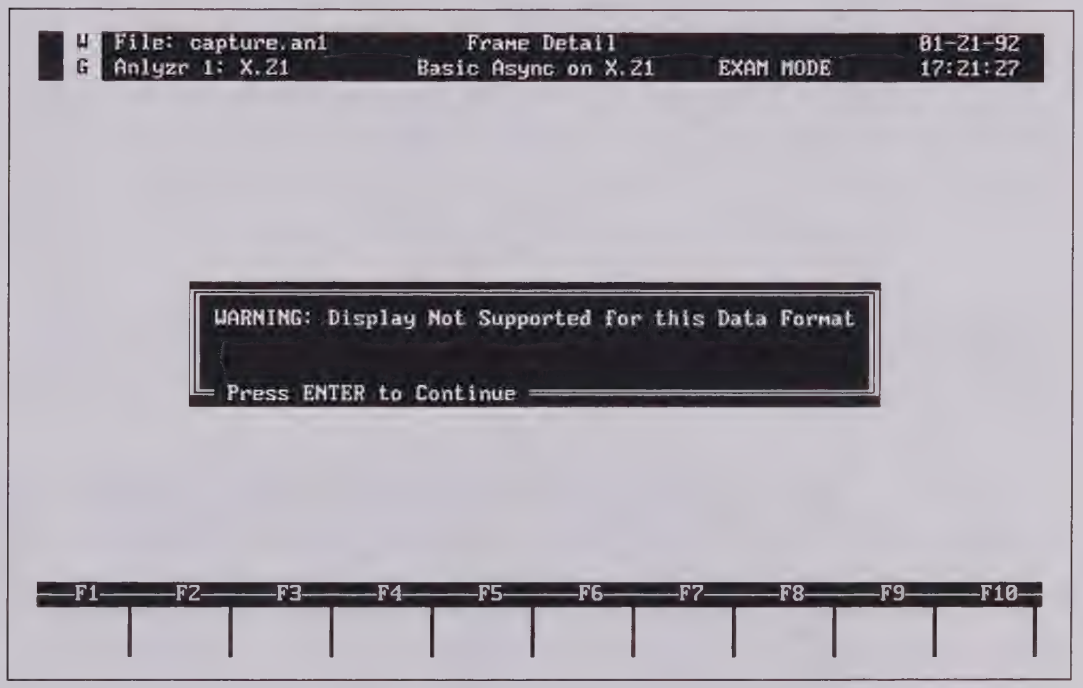

File: capture.an1 Frame Detail 01-21-92
Anlyzr 1: X.21 Basic Async on X.21 EXAM MODE 17:21:27
WARNING: Display Not Supported for this Data Format
Press ENTER to Continue
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10

Figure X21-25 Warning: Frame Detail in ASYNC

C:

Depending on the distance between the DA-30 and the DTE-DCE interface being monitored, you may then connect one of the free ends of the four-connector cable to one of the LIM rear panel connectors--either directly as shown in Figure V24/35-5 (a) or via a DB25 extension cable (user-supplied) as shown in Figure V24/35-5 (b).

E:

Depending on the distance between the DA-30 and the DTE-DCE interface being monitored, you may then connect one of the free ends of the four-connector cable to the LIM rear panel connector--either directly as shown in Figure V36-5 (a) or via a DB37 extension cable (user-supplied) as shown in Figure V36-5 (b).

Third Edition October 1993 Release 3.4 and after

HSX.21

High Speed X.21 Interface Operation

(Addendum to the X.21 Interface Operation Document)

HSX21.1. Introduction

The High Speed X.21 Interface boasts several enhancements over its counterpart that are summed up as follows:

- **Increase in Operating Speed**
  The High Speed X.21 Interface operates over a range of 50 bps to 2.048 Mbps whereas the X.21 Interface operates at no more than 256 kbps.

> **Note:**
>
> The High Speed X.21 Interface's ability to operate at higher speeds depends upon several factors including cable length, cable integrity, line setup, and signal strength.

- **Revised Setup Menus**
  The X.21 Interface setup menus have been revised and reorganized to produce the ones for the High Speed X.21 Interface. The revised menus are clearer and easier to understand. New fields have been added, and some existing fields have been given substantially new functionality.
- **New Network Status Screen**
  The High Speed X.21 Network Status screen contains all the original information on the X.21 Network Status screen. However, it provides additional status information and places less emphasis on the control leads.
- **Dropped Bisync and Async Data Framing**
  The High Speed X.21 Interface does not support character-oriented protocols (i.e. Bisync) or Asynchronous (Async) data framing. This interface supports only Bit-Oriented Protocols (BOPs).

This document is an addendum to the *X.21 Interface Operation* document. In addition to the above-mentioned enhancements, it describes the installation, external connections, and the software setup for the High Speed X.21 Interface.

HSX21.2. Installation

The actual Line Interface Module used for the High Speed X.21 Interface is identical to the one used for the X.21 Interface. The differences in their functionality stem from their corresponding feature modules, LIP software and LPP software.

> **Note:**
>
> Before you can use the High Speed X.21 Line Interface, you must also have a Protocol Analyzer Module and a High Speed WAN Feature Module installed.

HSX21.2.1. Loading the LIP & LPP Software

To load the LPP software:

(Substitute HS_X.21 for X.21.)

To load the LIP software:

(Substitute HS_X.21 for X.21.)

HSX21.3. Setting Up The Line Interface

By now, you have installed the Line Interface Module in the DA-30, installed and loaded the LIP and LPP software, and made the appropriate test connections for monitoring or emulation. You are now ready to setup the line interface for your particular test. Press F2 (line setup) to see the HS_X.21 Line Setup screen shown in Figure HSX21-1.

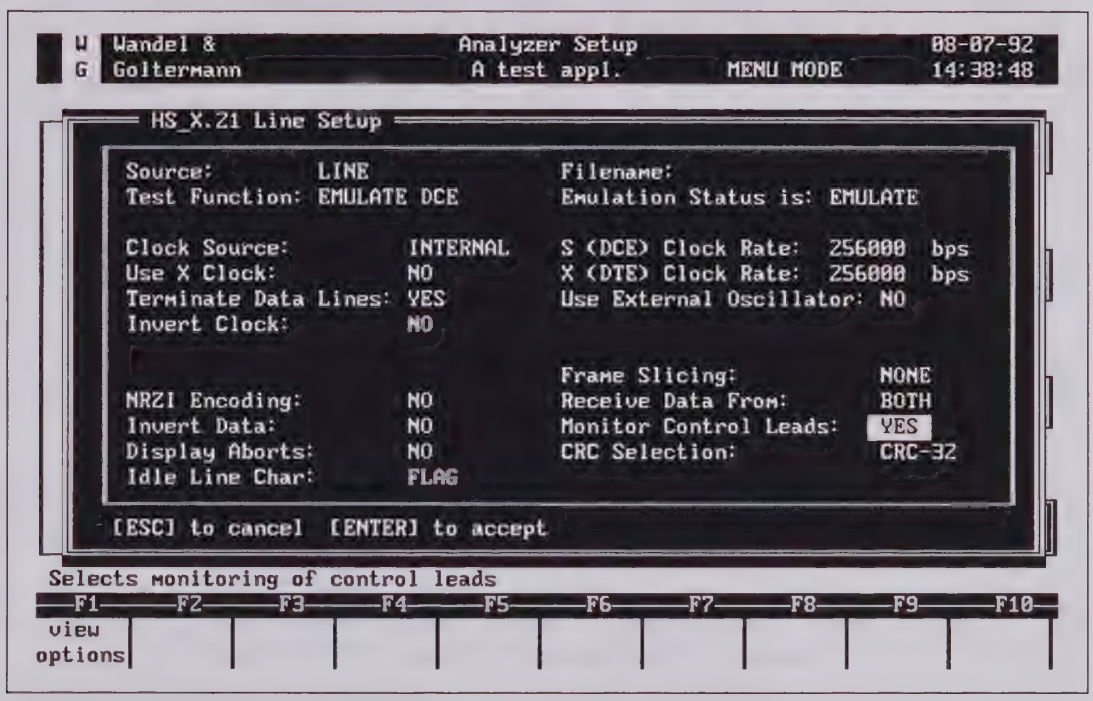


Figure HSX21-1 HS_X.21 Setup Screen

The Line Setup menu allows you to configure the data line parameters.

HSX21.3.1. Test Function

This field allows you to select between three modes of operation:

- RECEIVE ONLY – the DA-30 passively monitors network activity on both sides of the DTE-DCE interface. An uninterrupted signal path is provided between the rear panel DCE and DTE connectors. For example, pin 1 of the DCE connector is internally connected to pin 1 of the DTE connector. Received data is also processed according to the Network Event Program (if defined).
- EMULATE DCE – the DA-30 emulates a DCE device while appropriately driving the R, I, and S leads. This selection is used when testing DTE equipment (i.e. computer, terminal, etc.). Received data is also processed according to the Network Event Program (if defined).
- EMULATE DTE – the DA-30 emulates a DTE device while appropriately driving the T, C and X (optional) leads. This selection is used when testing DCE equipment (i.e. modem). Received data is also processed according to the Network Event Program (if defined).

HSX21.3.2. Clock Source

This field allows you to select the source of the clocks that the DA-30 provides to the interface. Your selections, here, are valid only in the Emulate DCE and Emulate DTE modes (Table 2).

There are two choices:

- EXTERNAL – "External" means that the source of the clocks provided by the DA-30 is one of the clock leads on the X.21 interface.

  This setting can also be used when emulating a DTE or DCE. If emulating a DTE, the frequency of X is determined by S which is provided by the DCE. If emulating a DCE, the frequency of S is determined by the circuit X which is provided by the DTE.

- INTERNAL – "Internal" simply means that the source of the clocks provided by the DA-30 is either the External Oscillator input or one of the crystal oscillators located on the HS WAN board.

  If emulating a DTE, the DA-30 will generate a clock frequency as close as possible to the rate entered in the DTE Clock Rate field and transmit it on X. If emulating a DCE, the DA-30 will generate a clock frequency as close as possible to the rate entered in the DCE Clock Rate field and transmit it on S.

Note:

The default selection for this field is automatically made based on your Test Function selection. You may override this default selection at any time.

When **Test Function** is set to:	**Clock Source** determines the source of:
Receive Only	No meaning
Emulate DCE	S clock
Emulate DTE	X clock (if Use X Clock is set to YES)

Table 1 Test Function vs Clock Source Control

HSX21.3.3. Use X Clock

This field allows you to enable the use of circuit X (DTE signal element timing) clock. This circuit is used when the DTE needs to generate its timing for circuit T.

The X.21 Specification reserves pins 7 and 14 on the DB-15 connector for the Byte (B) clock which is generated by the DCE and is synchronous with the first bit of every byte. However, the B clock is rarely used in practice, and these pins are more commonly used for the X clock (defined in the X.24 Specification). The choices are:

- NO – The DA-30 assumes that the interface is electrically setup for the B clock (according to the X.21 specification). However, the B clock is not supported. Thus, this selection has no function.
- YES – The DA-30 assumes that the interface is electrically setup for the X clock. The X clock is assumed to provide the timing for the data transmitted on T by the DTE.

HSX21.3.4. Terminate Data Lines

This field is used only when emulating and is automatically set to the correct default based on the Test Function setting.

- NO – This is the default when Test Function is set to RECEIVE ONLY.
- YES – This is the default when Test Function is set to EMULATE DCE or EMULATE DTE.

HSX21.3.5. Invert Clock

This field allows you to invert the polarity of the clocks. The choices are:

- NO – The clocks are left unchanged. This is the default selection.
- YES – Inverts the polarity of the S and X clocks. This means that the DA-30 receives data on the "Off-to-On" transition of S (rather than the On-to-Off" transition) and transmits data on the "On-to-Off" transition of X.

HSX21.3.6. Invert Data

This field enables the interface to meet MIL-188C signalling requirements by inverting the polarity of the data being transmitted on both T and R. The choices are:

- NO – The polarity of the data is left unchanged.
- YES – Inverts the polarity of the data.

HSX21.3.7. Display Aborts

This field allows you to select whether or not Aborted frames trigger a specific event in the Network Event Program.

- NO
- YES

This field defaults to NO.

HSX21.3.8. Idle Line Char

This field allows you to select the character that the receiver interprets as an idle line (no data being transmitted).

- FLAG – Sets the Idle Line Character to 7E (hex).
- MARK – Sets the Idle Line Character to FF (hex).

The default Idle Line Character is FLAG (7E).

HSX21.3.9. Filename

When the Source is set to FILE, you enter the name of the logged data file here. To see a list of available filenames to choose from, press F1 (view options). Use the cursor keys to highlight a filename and press Enter to load the file.

HSX21.3.10. Emulation Status

This field reports whether the DA-30 is currently monitoring or emulating depending on your Test Function selection (Table 2).

Test Function	Emulation Status
RECEIVE ONLY	MONITOR
EMULATE DCE	EMULATE
EMULATE DTE	EMULATE

Table 2 Emulation Status Field

This is a status field only and cannot be directly modified using the cursor.

HSX21.3.11. S (DCE) Clock Rate

When emulating a DCE and Clock Source is set to INTERNAL, this field is used to set the desired rate (in bits/sec) for the S clock.

The DA-30 will generate a frequency as close as possible to the entered value. This field defaults to 256000 bps.

Note:

In cases where you must have a frequency that the DA-30 cannot match, you can externally generate your desired frequency and apply it to the External Oscillator input on the rear panel of the High Speed WAN Feature Module. Remember to enable this input by setting Use External Oscillator to YES.

HSX21.3.12. X (DTE) Clock Rate

When emulating a DTE and Clock Source is set to INTERNAL, this field is used to set the desired rate (in bits/sec) for the X clock. Your selection in this field takes effect only when the Use X Clock field is set to YES and Clock Source is set to INTERNAL.

The DA-30 will generate a frequency as close as possible to the entered value. This field defaults to 256000 bps.

Note:

In cases where you must have a frequency that the DA-30 cannot match, you can externally generate your desired frequency and apply it to the External Oscillator input on the rear panel of the High Speed WAN Feature Module. Remember to enable this input by setting Use External Oscillator to YES.

HSX21.3.13. Use External Oscillator

This field determines whether or not the signal from the External Oscillator input (BNC) on the rear panel of the High Speed WAN Feature Module is used to generate the internal clocks. The choices are:

- YES – The internal clocks are derived from the clock signal at the External Oscillator input.The crystal oscillators on the High Speed WAN Feature Module are disabled. The frequency at the External Oscillator input will be calculated upon entering the Run Mode.
- NO – The internal clocks are derived from the crystal oscillators on the High Speed WAN Feature Module. The External Oscillator input is disabled.

This field defaults to NO.

HSX21.3.14. Frame Slicing

Frame Slicing is not valid when using the ASYNC data format.

HSX21.3.15. Receive Data From

The received data that is processed by the analyzer can come from either or both sides of the interface. This field allows you to make that selection. The choices are:

- BOTH – Signals from both the DTE and the DCE sides of the interface are passed to the analyzer.
- DTE – Only signals from the DTE side of the interface are passed up to the analyzer.
- DCE – Only signals from the DCE side of the interface are passed up to the analyzer.

This field defaults to BOTH.

HSX21.3.16. Monitor Control Leads

This field allows you to monitor the activity of the data and control leads (T, R, C and I). Selections in this field are valid only when Source is set to LINE. The choices are:

NO – The data and control leads are not monitored.

YES – The data and control leads are monitored. Their activity is displayed in the Control Lead Activity section of the Network Status screen. This selection allows you to program the interface using the control lead condition keywords. The "High Speed X.21 PAL Reference" section of the *DA-30/31 Line Interface Programming* binder provides information on the control lead condition keywords. This binder is part of the *DA-30/31 Programming Documentation Set* which is sold separately.

> **Note:**
>
> Enabling control lead monitoring may degrade overall performance by an unspecified amount.

This field defaults to NO.

HSX21.3.17. CRC Selection

This field allows you to select the frame check sequence (CRC) polynomial that is used. The choices are:

- CCITT-16 – Selects the following 16-bit CCITT polynomial:
  $(x^{16} + x^{12} + x^{5} + 1)$.
- CRC-32 – Selects the following 32-bit Ethernet polynomial:
  $(x^{32} + x^{26} + x^{23} + x^{22} + x^{16} + x^{12} + x^{11} + x^{10} + x^{8} + x^{7} + x^{5} + x^{4} + x^{2} + x + 1)$
- NONE – All CRC checking is disabled. No CRC is generated for transmitted frames, and all received frames are assumed to have good CRCs.

HSX21.4. TESTPREP Consistency Check

After you have completed the line setup and returned to the Main menu, you can run your current application by going to the Run Mode (press the Alt-Run keys). The DA-30 runs a program called TESTPREP that compiles your application before going to the Run Mode.

Note:

Recompilation does not always occur upon entering the Run Mode. Your application will be recompiled whenever the Source setting is modified.

HSX21.5. Front Panel LEDs

Either the B or X LED will be used for status indication—depending on the setting of the Use X Clock field.

HSX21.5.1. Network Status Screen

The Run Mode Network Status screen for the High Speed X.21 Interface has been revised. It contains all the information on the X.21 screen—with some additional information (Figure HSX21-2). However, less emphasis is placed on the control leads.

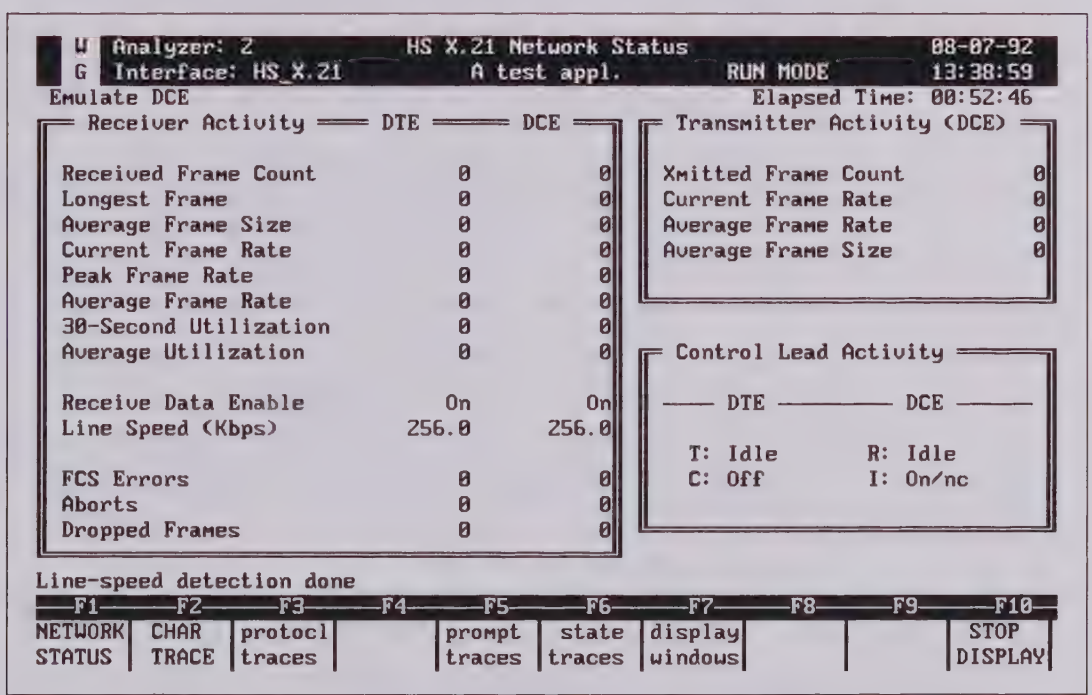


Figure HSX21-2 RUN Mode Network Status Screen

To access the Network Status screen, press F1 (NETWORK STATUS) from the Run Mode Top Rack.

The first line of this screen displays the current Test Function setting as well as an Elapsed Time counter that reports the time that elapsed since the current application started running.

The rest of the screen is subdivided into three sections that detail the Receiver Activity, Transmitter Activity, and Control Lead Activity.

HSX21.5.1.1. Receiver Activity

This section of the Network Status screen displays receiver information.

- Received Frame Count – the total number of frames received. This total includes the number of frames that were processed and the number of frames that were dropped (Dropped Frames). All frame rates and utilization calculations are based on this total.
- Longest Frame – the size (in bytes) of the longest frame that has been received since receiving began. The maximum frame size that can be received is 3928 bytes.
- Average Frame Size – the average size (in bytes) of the received frames since receiving began. The maximum frame size that can be received is 3928 bytes.
- Current Frame Rate – the frame rate (Frames per second) detected at the receiver.
- Peak Frame Rate – the highest frame rate (Frames per second) detected at the receiver since receiving began.
- 30-Second Utilization – the average utilization (%) for the past 30-second interval. This field is a "sliding-window" that is updated every second. During the first 30 seconds after entering Run Mode, this value is the average utilization for that period.
- Average Utilization – the average utilization (%) since receiving began.

Note:

The 30-Second Utilization and Average Utilization fields are supported when Test Function is set to:

- Emulate DCE
- Emulate DTE or Receive Only (if a clock is detected on S and/or X upon entering Run Mode).

Otherwise, these fields will display "Unavail".

- Receive Data Enable – This field tells which DTE and DCE are enabled for receiving. This field gets its information from the Receive Data From setting on the Line Setup menu (Table 3).

Receive Data From Setting	**Receive Data Enable** Status	
	DTE	**DCE**
BOTH	On	On
DCE	Off	On
DTE	On	Off

Table 3 Receive Data Enable Status Indicators

- Line Speed (Kbps) – On entering the Run Mode, the line speed is determined if possible. Once determined, this value is displayed here. The line speed value is also used to calculate the Average and 30-Second Utilization values.

If, for some reason, it is not possible to determine the line speed when entering the Run Mode (i.e. DA-30 not connected to the line in the RECEIVE ONLY or EMULATE DTE mode), the Line Speed and the utilization fields are displayed as unavailable ("Unavail").

- FCS Errors – this counter is incremented each time a Frame Check Sequence (CRC) error occurs.
- Aborts – this counter is incremented each time an Abort occurs. An Abort is defined to be the reception of seven (7) consecutive one (1) bits.
- Dropped Frames – This field provides a count of the number of frames that the Line Interface was able to receive, but the DA-30 itself could not accept for processing. The frames are "dropped," or thrown away, after being received.

HSX21.5.1.2. Transmitter Activity

This section of the Network Status screen displays transmitter information.

MON. When RECEIVER ONLY is the selected Test Function.

DTE. When EMULATE DTE is the selected Test Function.

DCE. When EMULATE DCE is the selected Test Function.

Whether emulating a DTE or DCE, this section reports the following information:

- Current Frame Rate – the frame rate for the last second of operation. This field is updated every second.

HSX21.5.1.3. Control Lead Activity

This section of the Network Status screen displays control and data lead information when receiving data from the line. The control and data lead fields are grouped by line-side emulation. Each control lead field displays an approximate representation of the corresponding control lead status. The state of the control leads is indicated as shown in Table 4.

Status	Meaning
On / nc	The control lead carries a positive voltage or is not connected (or connected to a "dead" line). The corresponding front-panel LED is unlighted.
Off	The control lead carries a negative voltage.

Table 4 Control Lead Status Indicators

The data leads (T and R) are monitored via software. The Line Interface Module has no direct method of determining the data lead status. The state of the data leads is indicated as shown in Table 5.

Status	Meaning
Data	A frame was received during the data lead sample interval.
Idle	A frame was not received during the data lead sample interval.

Table 5 Data Lead Status Indicators

As with the X.21 Interface, the High Speed X.21 Interface control lead activity is NOT correlated with the received frames. This means that the control lead activity is a frame-independent "snap shot" of the control leads at a given instant in time.

Note:

A majority of control lead events will be missed—especially at high bit rates.

This section of the screen is enabled only when Monitor Control Leads is set to YES on the Line Setup menu. When Monitor Control Leads is set to NO, the control lead fields are left blank, and "Monitoring Disabled" is displayed. The control leads fields are also left blank whenever playing back data from a logged file (i.e Source is set to FILE).

The last line of the Network Status screen reports the status of the line speed calculation (at the receiver). When the calculation is being performed, the following message is reported:

```
"Determining Line Speed"
```

After the calculation has been performed, the following message is reported:

```
"Line-speed detection done"
```

HSX21.5.2. Character Trace Screen, Run Mode

The Run Mode Character Trace screen looks just like the one described for the X.21 Interface. To access the Character Trace screen, press F2 (CHAR TRACE) from the Run Mode Top Rack. The Character Trace screen that appears is shown in Figure HSX21-3.

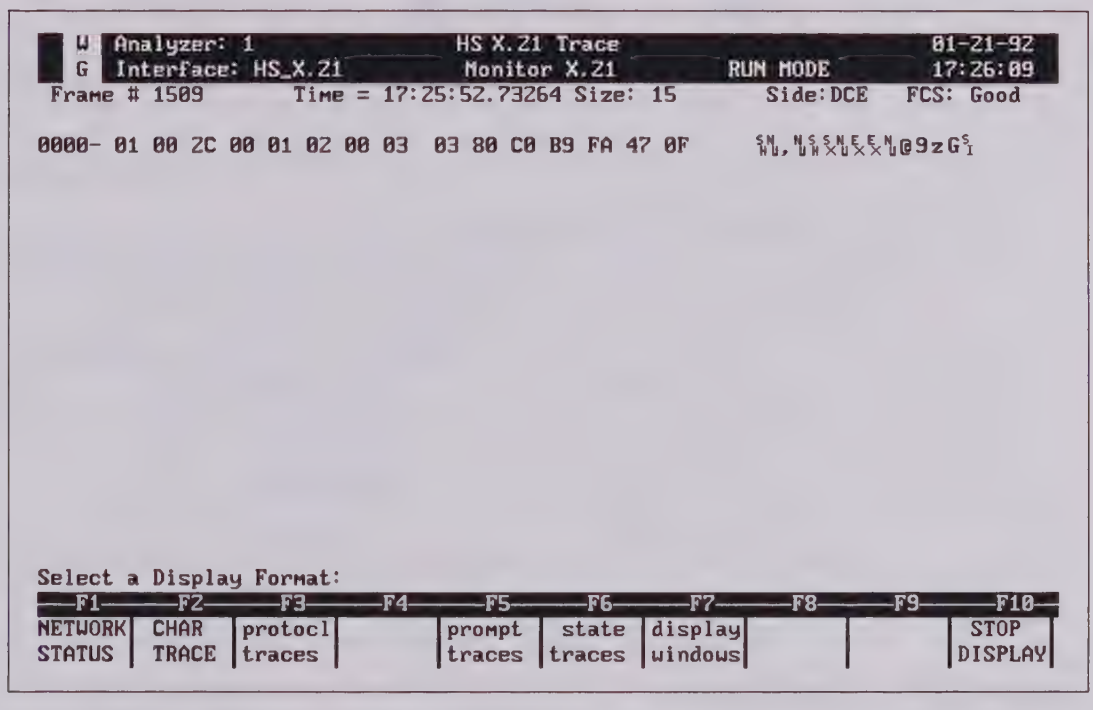


Figure HSX21-3 RUN Mode Character Trace Screen

HSX21.5.3. Character Trace Screen, Examine Mode

The Character Trace screen for the Examine Mode looks just like the one described in Run Mode. If there are higher-level protocol packages loaded and running, you can display their traces by pressing F3 (protocol traces) from the Exam Mode Top Rack. You can then selectively display frames based on multiple (core & protocol-specific) criteria by pressing F8 (display filters). You can also access the Frame Detail screen by pressing F9 (FRAME DETAIL) from the protocol traces softkey rack. The core find commands, as well as any other protocol-specific find commands, are available by pressing F10 (find command) from either the character or protocol trace softkey rack.

HSX21.6. High Speed X.21 Clock Configurations

In the High Speed X.21 package, we have made every attempt to provide the flexibility of clock routing that is required for a protocol analyzer—while keeping the setup as straightforward as possible. This section explains the different possible clock routing configurations and how to setup the High Speed X.21 Interface for each configuration.

There are three fields that are used to route the clocks: Test Function, Clock Source and Use X Clock. For each of the following configurations, a table is presented that shows you how to setup these clock routing fields for the corresponding configuration.

HSX21.6.1. Configuration 1

This is the default configuration (Figure HSX21-4) for the DA-30. In this configuration, the S clock is generated by the DCE and provides the timing for T and R.

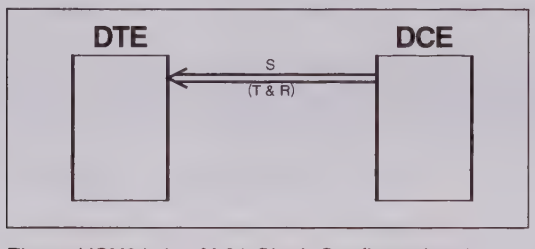


Figure HSX21-4 X.21 Clock Configuration 1

The clock routing setups for Configuration 1 are shown in Table 6.

Test Function	Clock Source	Use X Clock
RECEIVE ONLY	EXTERNAL	NO
EMULATE DCE	INTERNAL	NO
EMULATE DTE	EXTERNAL	NO

Table 6 Clock Setups for Clock Configuration 1

HSX21.6.2. Configuration 2

In this configuration (Figure HSX21-5), the DCE generates the S clock and provides the timing for R. The DTE also uses S to clock data out on T. The DTE regenerates the S clock on the X clock circuit and synchronizes it with the data on T. The DCE then uses X to receive T data.

This implementation is often used at clock rates above 300 kHz to compensate for skew between S and T caused by propagation delay.

The clock routing setups for Configuration 2 are shown in Table 7.

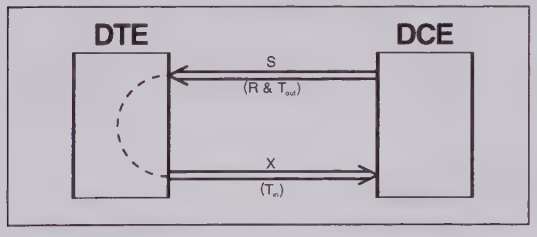


Figure HSX21-5 X.21 Clock Configuration 2

Test Function	Clock Source	Use X Clock
RECEIVE ONLY	EXTERNAL	YES
EMULATE DCE	INTERNAL	YES
EMULATE DTE	EXTERNAL	YES

Table 7 Clock Setups for Clock Configuration 2

HSX21.6.3. Configuration 3

In this configuration (Figure HSX21-6), the DTE generates a clock on X. The DCE takes X and loops it back on S. X provides the timing for T and S provides the timing for R.

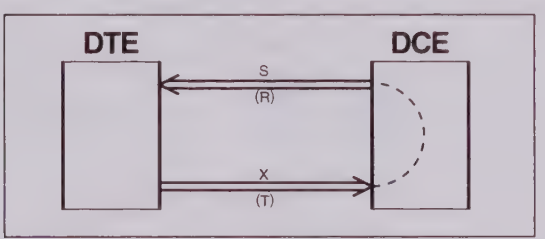


Figure HSX21-6 X.21 Clock Configuration 3

The clock routing setups for Configuration 3 are shown in Table 8.

Test Function	Clock Source	Use X Clock
RECEIVE ONLY	EXTERNAL	YES
EMULATE DCE	EXTERNAL	YES
EMULATE DTE	INTERNAL	YES

Table 8 Clock Setups for Clock Configuration 3

HSX21.6.4. Configuration 4

In this configuration (Figure HSX21-7), the DCE generates S which provides the timing for R. The DTE generates X which provides the timing for T.

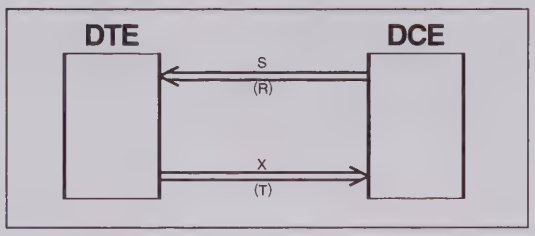


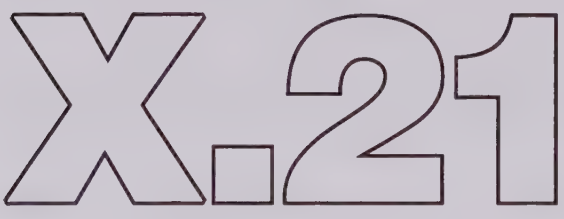
Figure HSX21-7 X.21 Clock Configuration 4

The clock routing setups for Configuration 4 are shown in Table 9.

Test Function	Clock Source	Use X Clock
RECEIVE ONLY	EXTERNAL	YES
EMULATE DCE	INTERNAL	YES
EMULATE DTE	INTERNAL	YES

Table 9 Clock Setups for Clock Configuration 4

Fifth Edition October 1993 Release 3.4 and after



X.21 PAL References

X21.1. Introduction

The X.21 PAL keywords contained in the Layer Protocol Package (LPP) allow you to write protocol-specific Network Event Programs and use them in X.21 applications. These keywords can be used by themselves or in combination with core keywords within an event. The Network Event Program simplifies the programming process with the softkey-guided mode.

PAL keywords are available in the Network Event Program Editor only when the X.21 LPP is loaded at Layer 1 of the DA-30 protocol stack. Using PAL with the X.21 Interface is, essentially, a way to monitor and manipulate the Control (C) and Indication (I) leads.

The PAL keywords are divided into the following two groups:

- protocol condition keywords
- protocol action keywords

X21.2. Protocol Condition Keywords

The protocol condition keywords allow you to evaluate frames received from a DTE or DCE as well as monitor the Control and Indication leads. The protocol condition keywords available for evaluating received frames are:

- RCVD
- BAD.FCS
- ABORT
- PARITY
- FRAME ERROR

The protocol condition keywords available for monitoring the Control and Indication leads are:

- C
- I

> **Note:**
>
> When using the control lead condition keywords, be sure to set the Monitor Control Leads field (of the Line Setup menu) to YES. Otherwise, the status of the control leads will be ignored.

The discussion of each keyword includes a syntactical model, a description and an example of its use.

RCVD

Syntax: DCE RCVD
DTE RCVD

Description: This condition is true when a valid frame is received. It can be used for either the DTE or DCE side of the interface.

Type: External

Example:
```
COND DCE RCVD
ACTN PROMPT "Frame received on DCE side"
```

Remarks: None

BAD.FCS

Syntax:

DCE BAD.FCS
DTE BAD.FCS

Description:

This condition is true when a frame with a bad frame check sequence is received. It can be used for either the DTE or DCE side of the interface.

Type:

External

Example:

```
COND DTE BAD.FCS
ACTN PROMPT "The frame has bad FCS"
```

Remarks:

None

ABORT

Syntax: DCE ABORT
DTE ABORT

Description: This condition is true when either an aborted frame or an aborted frame sequence – following the previous flag – is received. It can be used for either the DTE or DCE side of the interface.

Type: External

Example:
```
COND DTE ABORT
ACTN PROMPT "Aborted frame"
```

Remarks: None

PARITY

Syntax:

DCE PARITY
DTE PARITY

Description:

This condition is true when there is a parity error in the frame. It can be used for either the DTE or DCE side of the interface.

Type:

External

Example:

```
COND DTE PARITY
ACTN PROMPT "DTE parity error received"
```

Remarks:

Parity is evaluated according to the Parity setting on the Line Setup menu.

FRAME ERROR

Syntax: DCE FRAMING.ERROR
DTE FRAMING.ERROR

Description: This condition is true when a framing error is detected. It can be used for either the DTE or DCE side of the interface.

Type: External

Example:

```
COND DTE FRAMING.ERROR
ACTN PROMPT "FRAME ERROR. Evaluate now!"
```

Remarks: None

C

Syntax:

C ON
C OFF

Description: This condition is true when the Control (C) pin makes a transition to the specified state. The valid states are ON and OFF.

Type: External

Example:

```
LAYER 1
       STATE one
              COND C ON
              ACTN PROMPT "Control circuit on"
```

Remarks: None

I

Syntax:

I ON
I OFF

Description: This condition is true when the Indication (I) pin makes a transition to the specified state. The valid states are ON and OFF.

Type: External

Example:

```
COND I ON
ACTN PROMPT "Indication circuit on"
```

Remarks: None

X21.3. Protocol Action Keywords

The protocol action keywords allow you to manipulate (drive) the interface Control (C) and Indication (I) leads. The protocol action keywords available for manipulating the Control and Indication leads are:

- C
- I

The discussion of each keyword includes a syntactical model, a description and an example of its use.

> **Note:**
>
> Using PAL to drive the Control and Indication leads is only valid when Test Mode on the Line Setup is set to Emulate. The C keyword is valid only when emulating a DTE, the I keyword is valid only when emulating a DCE.

Since the protocol action keywords allow you to freely drive the Control and Indication leads ON or OFF, it is possible to inadvertently violate the X.21 rules of control signalling that is required for data transmission. At the same time, this freedom allows you to emulate/test for atypical or erroneous control signalling.

C

Syntax:

C ON
C OFF

Description:

This action drives the Control (C) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:

```
LAYER 1
       STATE one
              COND DCE RCVD
              ACTN C ON
                PROMPT "DCE received and C now on"
```

Remarks:

The DA-30 must be emulating a DTE. If the DA-30 is emulating DCE, it cannot drive the Control circuit.

I

Syntax:

I ON
I OFF

Description: This action drives the Indication (I) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:

```
LAYER 1
       STATE one
              COND DTE RCVD
              ACTN I OFF
```

Remarks: The DA-30 must be emulating a DCE. If the DA-30 is emulating DTE, it cannot control the Indication circuit.

HSX.21

High Speed X.21 PAL References

(Addendum to the X.21 PAL References Document)

HSX21.1. Introduction

The programming features of the High Speed X.21 Interface are practically the same as those of the X.21 Interface. However, the ability to saturate (flood) the network with user-defined frames has been added. Two new PAL keywords associated with the "flood network" functionality have been added to the Layer Protocol Package (LPP):

- FLOOD.NETWORK
- STOP.FLOOD.NETWORK.

The HS_X.21 PAL keywords contained in the Layer Protocol Package (LPP) allow you to write protocol-specific Network Event Programs and use them in X.21 applications. These keywords can be used by themselves or in combination with core keywords within an event. The Network Event Program simplifies the programming process with the softkey-guided mode.

High Speed X.21 PAL keywords are available in the Network Event Program Editor only when the HS_X.21 LPP is loaded at Layer 1 of the DA-30 protocol stack. Using PAL with the X.21 Interface is, essentially, a way to monitor and manipulate the Control (C) and Indication (I) leads.

The PAL keywords are divided into the following two groups:

- protocol condition keywords
- protocol action keywords

HSX21.2. Protocol Condition Keywords

The protocol condition keywords allow you to evaluate frames received from a DTE or DCE as well as monitor the control leads. The protocol condition keywords available for evaluating received frames are:

- RCVD
- BAD.FCS
- ABORT
- FRAME ERROR

The protocol condition keywords available for monitoring the Control and Indication leads are:

- C
- I

> **Note:**
>
> When using the control lead condition keywords, be sure to set the Monitor Control Leads field (of the Line Setup menu) to YES. Otherwise, the status of the control leads will be ignored.

The discussion of each keyword includes a syntactical model, a description and an example of its use.

RCVD

Syntax: DCE RCVD
DTE RCVD

Description: This condition is true when a valid frame is received. It can be used for either the DTE or DCE side of the interface.

Type: External

Example:
```
COND DCE RCVD
ACTN PROMPT "Frame received on DCE side"
```

Remarks: None

BAD.FCS

Syntax:

DCE BAD.FCS
DTE BAD.FCS

Description:

This condition is true when a frame with a bad frame check sequence is received. It can be used for either the DTE or DCE side of the interface.

Type:

External

Example:

```
COND DTE BAD.FCS
ACTN PROMPT "The frame has bad FCS"
```

Remarks:

None

ABORT

Syntax:

DCE ABORT
DTE ABORT

Description:

This condition is true when either an aborted frame or an aborted frame check sequence—following the previous flag—is received. It can be used for either the DTE or DCE side of the interface.

Type:

External

Example:

```
COND DTE ABORT
     TIMEOUT count.down OR
ACTN PROMPT "Aborted frame or timeout"
```

Remarks:

None

FRAME ERROR

Syntax:

DCE FRAMING.ERROR
DTE FRAMING.ERROR

Description:

This condition is true when a framing error is detected. It can be used for either the DTE or DCE side of the interface.

Type:

External

Example:

```
COND DTE FRAMING.ERROR
ACTN PROMPT "FRAME ERROR. Evaluate now!"
```

Remarks:

None

C

Syntax:

C ON
C OFF

Description:

This condition is true when the Control (C) pin makes a transition to the specified state. The valid states are ON and OFF.

Type:

External

Example:

```
LAYER 1
       STATE one
              COND C ON
              ACTN PROMPT "Control circuit on"
```

Remarks:

None

I

Syntax:

I ON
I OFF

Description: This condition is true when the Indication (I) pin makes a transition to the specified state. The valid states are ON and OFF.

Type: External

Example:

```
COND I ON
ACTN PROMPT "Indication circuit on"
```

Remarks: None

HSX21.3. Protocol Action Keywords

The protocol action keywords allow you to manipulate (drive) the interface Control (C) and Indication (I) leads as well as flood a network. The protocol action keywords available for manipulating the Control and Indication leads are:

- C
- I

The discussion of each keyword includes a syntactical model, a description and an example of its use.

The protocol action keywords available for network flooding are:

- FLOOD.NETWORK
- STOP.FLOOD.NETWORK

The discussion of each keyword includes a syntactical model, a description and an example of its use.

Note:

Using PAL to drive the Control and Indication leads is only valid when when Test Function on the Line Setup is set to Emulate. The C keyword is valid only when emulating a DTE, the I keyword is valid only when emulating a DCE. Since the protocol action keywords allow you to freely drive the Control and Indication leads ON or OFF, it is possible to inadvertently violate the X.21 rules of control signalling that is required for data transmission. At the same time, this freedom allows you to emulate/test for atypical or erroneous control signalling.

C

Syntax:

C ON
C OFF

Description: This action drives the Control (C) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:

```
LAYER 1
       STATE one
              COND DCE RCVD
              ACTN C ON
                PROMPT "DCE received and C now on"
```

Remarks: The DA-30 must be emulating a DTE. If the DA-30 is emulating DCE, it cannot drive the Control circuit.

I

Syntax:

I ON
I OFF

Description:

This action drives the Indication (I) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:

```
LAYER 1
       STATE one
              COND DTE RCVD
              ACTN I OFF
```

Remarks:

The DA-30 must be emulating a DCE. If the DA-30 is emulating DTE, it cannot control the Indication circuit.

FLOOD.NETWORK

Syntax: FLOOD.NETWORK

Description: This action saturates the network with a user-defined string. In addition, the time interval between the frames may be selected (with 1 microsecond resolution) to control the saturation level of the network.

Example:

```
FLOOD.NETWORK "string"      TIME.GAP    [microseconds]
```

Remarks: None

STOP.FLOOD.NETWORK

Syntax: STOP.FLOOD.NETWORK

Description: This action stops the flood of the network after the current frame has been completely transmitted.

Example:

```
STOP.FLOOD.NETWORK
```

Remarks: None

RS-232C / V.24 / V.35 Interface Operation Errata Sheet
March 1994

This is an errata sheet to the RS-232C /V.24 / V.35 Interface Operation document, which is located in the *Line Interface Operation* binder.

As of Release 3.4.2, the maximum frame size on high speed WAN interfaces is 3984 bytes. The maximum frame size on standard WAN interfaces is 4012 bytes. This refers to the maximum frame size that can be displayed, not the maximum frame size that can be captured by the DA-3x. If a frame longer than the size limit is received, its length is displayed as the maximum length (3984 or 4012), and only that number of bytes is displayed in the frame detail and character trace. All frames, including those that exceed the maximum frame size, can be captured by the DA-3x.

Frame size references are made on the following pages of the RS-232C / V.24 / V.35 Interface Operation document.

Section V24/35.7.1.1: Receiver (or Playback) Activity

page V.24/V.35-31:

- Longest Frame - the size (in bytes) of the longest frames that has been received since receiving began. The maximum frame size that can be received is 4012 bytes.

Section HSV24/35.5.1.1: Receiver Activity

page HSV24/V35-18:

Note:
The maximum receive frame size is 3984 bytes.

RS-232C/V.24/V.35 Interface Operation Errata Sheet
March 1994

Fifth Edition October 1993 Release 3.4 and after

V.24/V.35

RS-232C / V.24 and V.35 Interface Operation

V24/35.1. Introduction

The RS-232C/V.24 and V.35 Interfaces give the DA-30 the ability to monitor and/or emulate a DTE or DCE on a Wide Area Network (WAN). Figure V24/35-1 shows where the DA-30 fits into a WAN communications system.

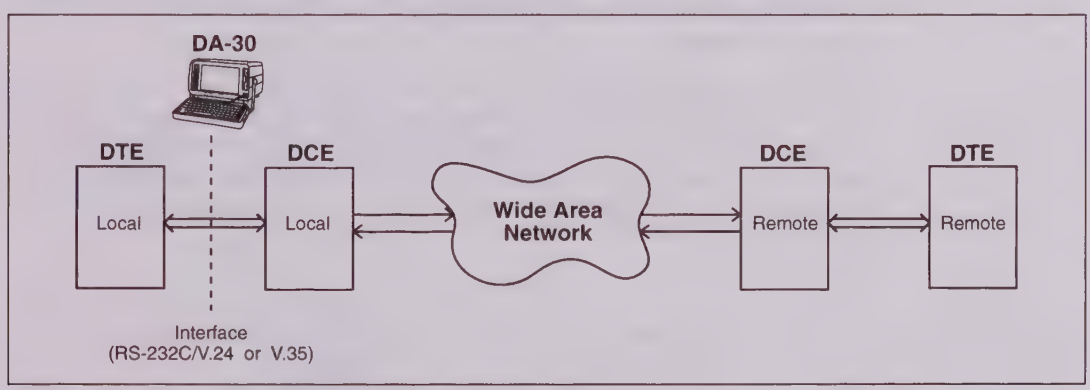


Figure V24/35-1 DA-30 in a WAN Communications System

These WAN Interfaces provide for three operating modes: emulate DTE, emulate DCE, and monitor. They can also transmit and receive using both synchronous and asynchronous data formats.

Because the configuration and operation of these line interfaces are very similar, this document describes the installation, external connections, and the software setup for both the RS-232C/V.24 and V.35 Line Interface Modules.

V24/35.2. Installation

The RS-232C/V.24 and V.35 Interfaces derive their basic functionality from the following:

- Line Interface Module (LIM)—circuit board
- WAN Feature Module
- Line Interface Package (LIP)
- Layer Protocol Package (LPP)

> **Note:**
>
> Before you can use either of these WAN Interfaces, you must also have a Protocol Analyzer Module and a WAN Feature Module installed.

V24/35.2.1. Installing the LIM and Installing LIP & LPP Software on the Hard Disk

Installing the LIM:

For instructions on how to install the RS-232C/V.24 and V.35 LIMs, refer to the installation procedures described in the "Installing Hardware Accessories" appendix of the *DA-30/31 Operating Manual*.

At the top edge of the LIM, there is a bank of 8 jumper posts that are grouped into 4 pairs – labelled W1, W2, W3 and W4. These jumper posts are not used on the V.35 LIM. However, the RS-232C/V.24 LIM comes with jumpers installed on these posts that connect rise-time control capacitors to the output of the clock and data interface drivers. These capacitors ensure compliance with the 30V/µs slew rate (rise-time) restriction of the RS-232C/V.24 specification.

> **Note:**
>
> Do not remove these jumpers. Without them, the LIM will not satisfy the slew rate requirement of the RS-232C/V.24 specification.

Installing the LIP & LPP Software:

For instructions on how to install the LIP & LPP software onto the hard disk, refer to the installation procedures described in the "Installing Software" appendix of the *DA-30/31 Operating Manual*.

V24/35.2.2. Loading the LIP & LPP Software

Before using your DA-30 for WAN testing, you should load the LPP software on the OSI protocol stack and then load the LIP software in the card slot containing the LIM.

To load the LPP software:

From the Main Menu, access the protocol stack by moving the cursor to the Active Protocols field within the current Analyzer window and pressing F2 (protocol stack). When the protocol stack appears, move the cursor to the Physical Layer (1), press F1 (view options), and select the appropriate package (RS232_V.24 or V.35) from the list.

To load the LIP software:

Move the cursor to the card slot window that corresponds to the slot containing the LIM. Press F1 (view options). Move the cursor to the appropriate package (RS232_V.24 or V.35) and press Enter.

V24/35.3. Making The Connections

A DB25 four-connector cable and a pair of V.35 adapter cables are provided so that you can make the necessary interface connections for your testing. See Figure V24/35-2. The four-connector cable has two, 25-pin connectors on each end. One is male, and the other is female to give you connection flexibility. The same signals are available on all of the connectors. For some testing configurations, you will need an additional DB25 cable.

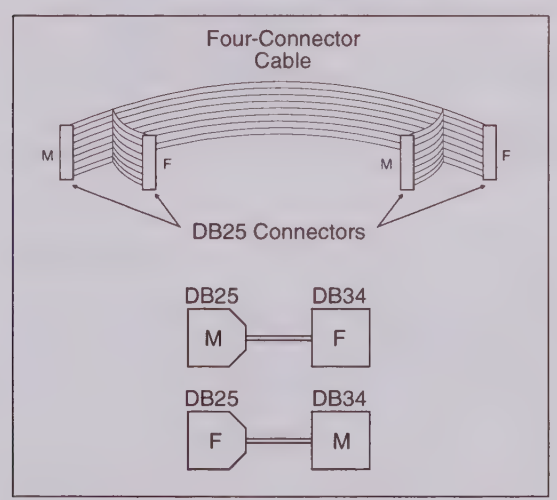


Figure V24/35-2 Four-Connector Cable & V.35 Adapter Cables

The two V.35 adapter cables come in handy if you have the V.35 LIM. On one end, there is a DB25 connector. On the other, a DB34 connector. They are provided so that you can use the DB25 four-connector cable to attach to the V.35 connectors on V.35 devices.

Note:

There are two basic varieties of the V.35 connector – distinguished by their manufacturers – AMP (Amphenol) and Winchester. The metallic shields of these connectors are incompatible and do not allow the pins to make contact. If you experience this problem when connecting the V.35 side of the V.35 adapter cable to your V.35 equipment, check to see if the adapter and your connector are made by the same manufacturer. If not, you should order the type of V.35 adapter cable that matches the connector on your equipment. See Table 1.

V.35 Adapter Cables			
Set #	**Manufacturer**	**Description**	**Order (BN) #**
1	AMP	25P (F) + 34P (M) 180mm, 0.062" dia.	K 439
	AMP	25P (M) + 34P (F) 180mm, 0.062" dia.	K 440
2	Winchester	25P (F) + 34P (M) 180mm, 0.040" dia.	K 470
	Winchester	25P (M) + 34P (F) 180mm, 0.040" dia.	K 471
3	Winchester	25P (F) + 34P (M) 180mm, 0.062" dia.	K 462
	Winchester	25P (M) + 34P (F) 180mm, 0.062" dia.	K 463

Table 1 Order Table for V.35 Adapter Cables

V24/35.3.1. The Rear Panel

Figure V24/35-3 shows the rear panel of the RS-232/V.24 and the V.35 Line Interface Modules.

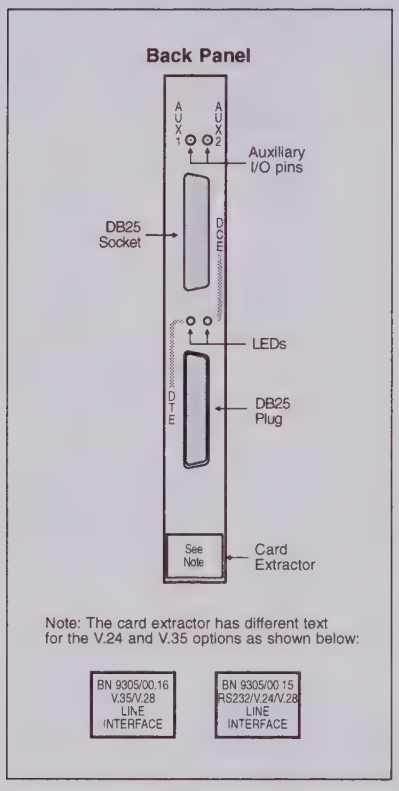


Figure V24/35-3 Rear Panel of RS232C/V.24 & V.35 Line Interface Modules

V24/35.3.1.1. Connectors

The LIM provides two 25-pin (DB25) connectors on the rear panel. The top connector (female) is labelled DCE, and the bottom connector (male) is labelled DTE. The connector labels refer to the identity of the DA-30 during emulation.

V24/35.3.1.2. Connector LEDs

Between the two DB25 connectors are two orange LEDs. The left LED corresponds to the DTE connector, and the right LED corresponds to the DCE connector. These LEDs indicate the LIM's test mode as shown in Table 2.

DTE LED	DCE LED	Test Mode
OFF	OFF	Monitor
ON	OFF	Emulate DTE
OFF	ON	Emulate DCE

Table 2 Connector LEDs and the Test Mode

V24/35.3.1.3. Auxiliary I/O Pins

Only 11 of the 25 specified interface signals can actually be driven or monitored by the LIM. See Figure V24/35-4. The other 14 signals are simply passed from one connector to the other. Each signal has a corresponding LED on the front panel that indicates its status. The front panel LEDs and LED Overlay are discussed in the "Front Panel LEDs" section.

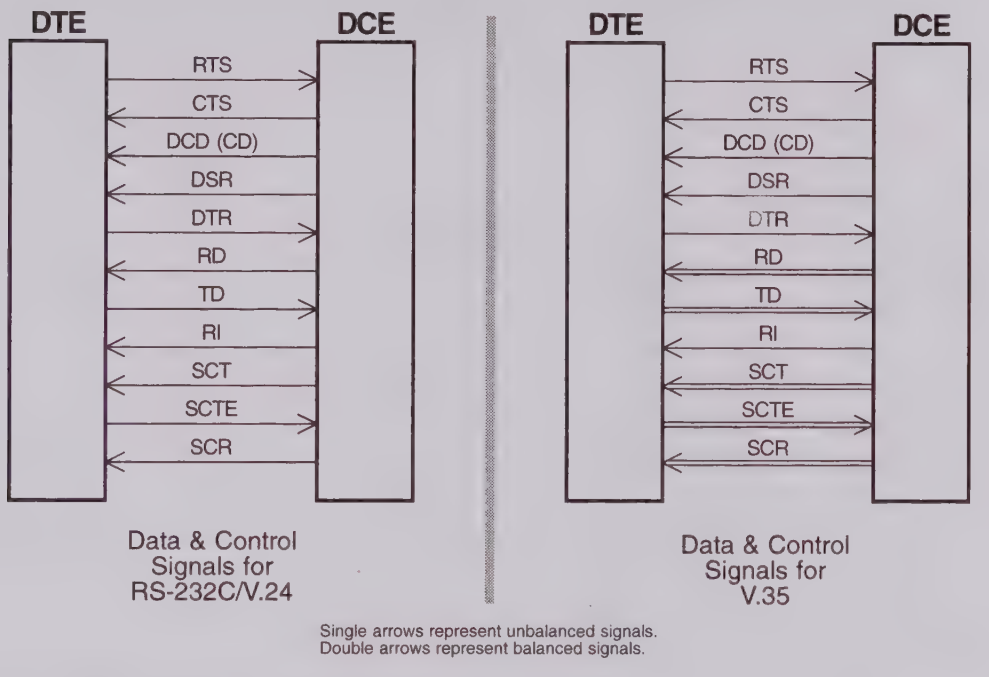


Figure V24/35-4 Supported Interface Signals

In the event that you need to drive or monitor one of the other 14 signals, two recessed (jumper post type) pins – labelled AUX 1 and AUX 2 – are provided at the top of the rear panel. These pins can be monitored/driven (one-at-a-time) under the control of a Network Event Program (NEP) with the use of interface-specific PAL (Protocol Analysis Language) keywords. The NEP and the RS-232C/V.24 and V.35 PAL keywords are described in the V.24 and V.35 PAL Reference section of the *Line Interface Programming* binder. This binder is part of the DA-30/31 Programming Documentation Set which is sold separately. The status of of the AUX 1 pin is displayed by the front-panel LED that is labelled U/A (User Assigned).

Note:

The use of the AUX 2 pin is currently not implemented.

V24/35.3.2. Connecting For Monitoring

When in the Monitor mode, the LIM internally connects the two 25-pin connectors—providing an uninterrupted signal path between them. That is, pin 1 of the DCE connector is internally connected to pin 1 of the DTE connector.

There are two basic monitoring configurations. In the first, the DB25 four-connector cable (supplied by W&G) is connected between the DTE and DCE. Depending on the distance

between the DA-30 and the DTE-DCE interface being monitored, you may then connect one of the free ends of the four-connector cable to one of the LIM rear panel connectors—either directly as shown in Figure V24/35-5 (a) or via a DB25 extension cable (user-supplied) as shown in Figure V24/35-5 (b).

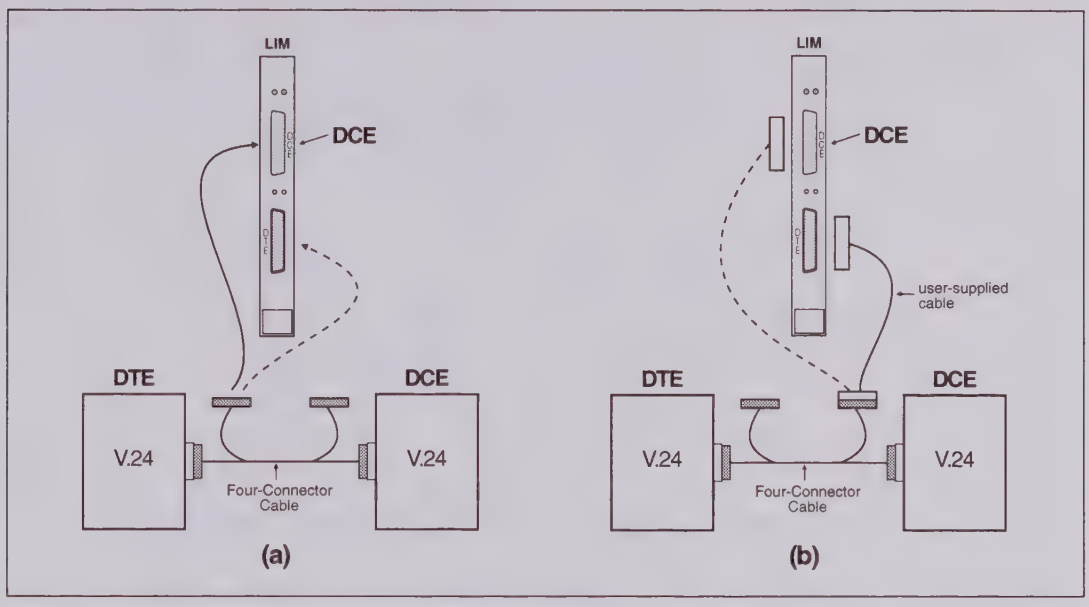


Figure V24/35-5 Monitoring Configuration # 1 (a) & (b)

In the second configuration, the four-connector cable is connected between the LIM's DCE connector and the DTE. Another (user-supplied) DB25 cable is connected between the LIM's DTE connector and the DCE. See Figure V24/35-6. These connections could also be reversed (i.e. the four-connector cable between the LIM's DTE connector and DCE, etc.).

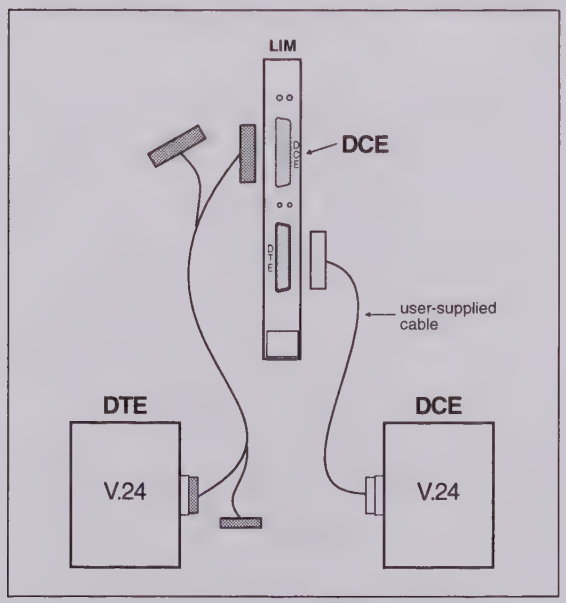


Figure V24/35-6 Monitoring Configuration # 2

The above monitoring configurations are described for monitoring a RS-232C/V.24 interface. If you are monitoring a V.35 interface, you would use the V.35 cable adapters to enable the four-connector cable to attach to a V.35 connector. See Figure V24/35-7.

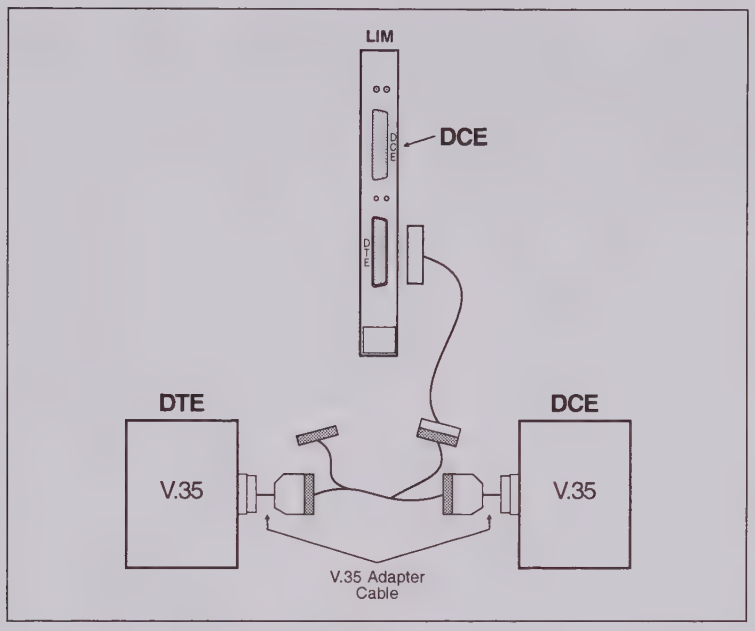


Figure V24/35-7 Monitoring Configuration # 1 Using a V.35 Interface

V24/35.3.3. Connecting For DTE Emulation

When in the Emulate DTE mode, the LIM is used to test DCE devices. In the emulate DTE configuration, the four-connector cable is connected between the LIM's DTE connector and the DCE. See Figure V24/35-8 (a).

If you are emulating a V.35 interface, you would use the DB25-to-V.35 adapter cables to enable the four-connector cable to attach to a V.35 connector. See Figure V24/35-8 (b).

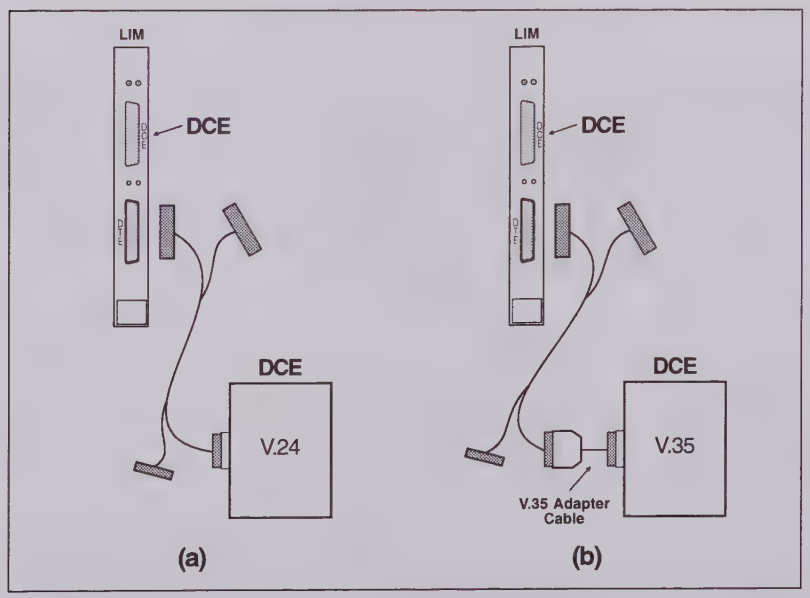


Figure V24/35-8 Emulate DTE Configuration (a) RS232C/V.24 (b) V.35

V24/35.3.4. Connecting For DCE Emulation

When in the Emulate DCE mode, the LIM is used to test DTE devices. In the emulate DCE configuration, the four-connector cable is connected between the LIM's DCE connector and the DTE. See Figure V24/35-9 (a).

If you are emulating a V.35 interface, you would use the V.35 cable adapters to enable the four-connector cable to attach to a V.35 connector. See Figure V24/35-9 (b).

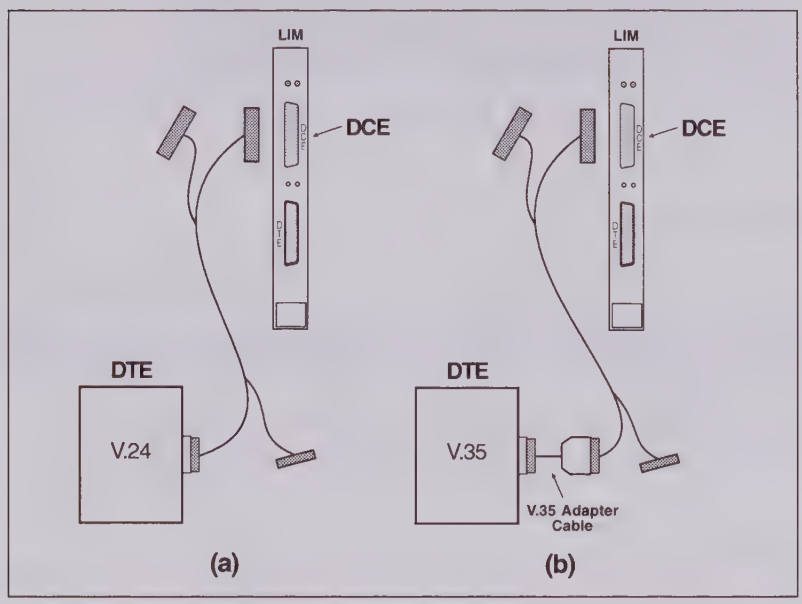


Figure V24/35-9 Emulate DCE Configuration (a) RS232C/V.24 (b) V.35

V24/35.4. Setting Up The Line Interface

By now, you have installed the LIM in the DA-30, installed and loaded the LIP and LPP software, and made the appropriate test connections for monitoring or emulation. You are now ready to setup the line interface for your particular test. To perform the setup, press F2 (line setup) to see the top level setup screen (RS232_V.24 Setup or V.35 Setup) shown in Figure V24/35-10. You may select either of the following three setup menus:

- Line Setup
- Control Lead Setup
- CRC Setup

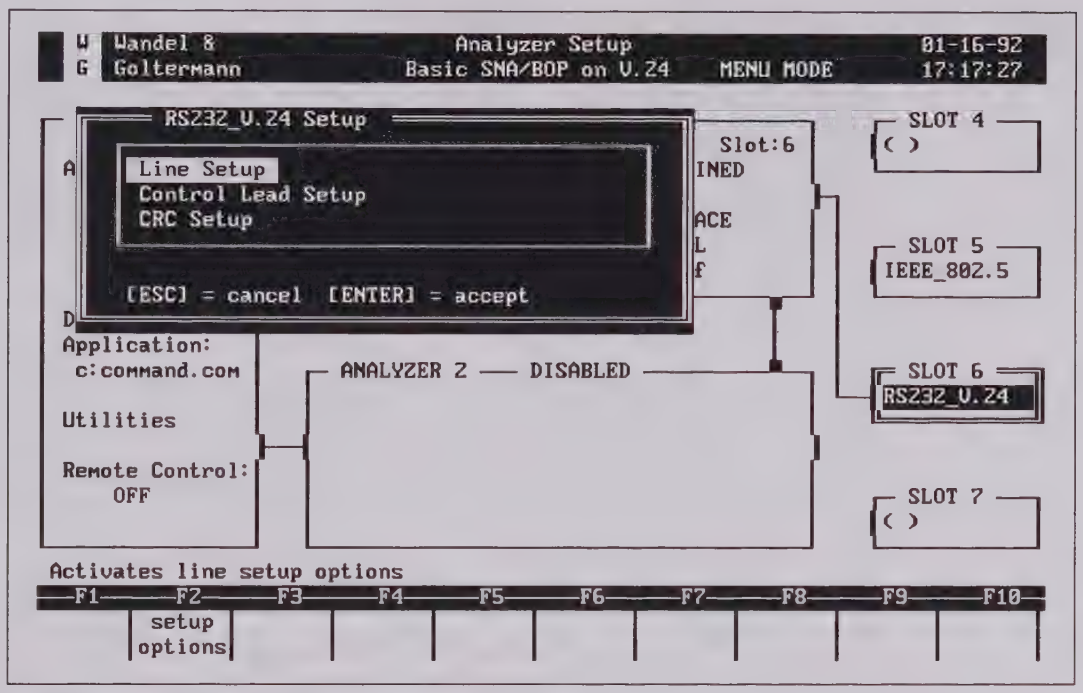


Figure V24/35-10 Top Level Setup Screen

V24/35.4.1. The Line Setup

The cursor should already be on Line Setup. Press F2 (setup options) to see the Line Setup menu shown in Figure V24/35-11.

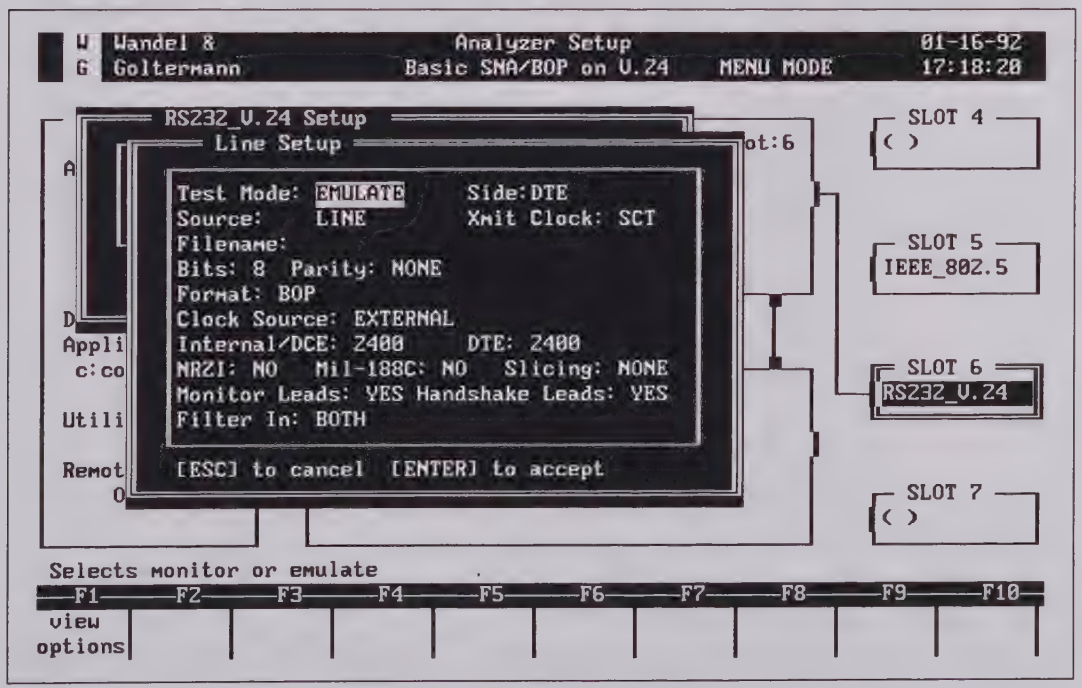


Figure V24/35-11 Line Setup

The Line Setup menu allows you to configure the data line parameters.

V24/35.4.1.1. Test Mode

This field allows you to select between two modes of operation:

- MONITOR – the DA-30 passively monitors network activity on both sides of the DTE-DCE interface. An uninterrupted signal path is provided between the rear panel DCE and DTE connectors. For example, pin 1 of the DCE connector is internally connected to pin 1 of the DTE connector. Received data is also processed according to the Network Event Program (if defined).
- EMULATE – the DA-30 transmits network data and drives the appropriate control leads—depending on the type of emulation (DTE or DCE). Received data is also processed according to the Network Event Program (if defined).

V24/35.4.1.2. Side

When the selected Mode is EMULATE, this field allows you to select the side of the DTE-DCE interface to Emulate.

- DTE – the DA-30 emulates a DTE device while appropriately driving the RTS, DTR, and SCTE leads. This selection is used when testing DCE equipment (i.e. modem).
- DCE – the DA-30 emulates a DCE device while appropriately driving the CTS, CD, DSR, SCT, and SCR leads. This selection is used when testing DTE equipment (i.e. computer, terminal, etc.).

V24/35.4.1.3. Source

The DA-30 is able to analyze data from two sources:

- Line – The physical network is the source of the data.
- File – A logged data file is the source of the data.

V24/35.4.1.4. Xmit Clock

When the selected mode is EMULATE, you must choose the type of transmit timing. The choices are:

- SCT – the DA-30's internal clock is used for transmitting. Use this setting to emulate a DCE.
- SCTE – an external clock is used for transmitting. Use this setting to emulate either a DTE or DCE. When external clocking is used, the DCE expects to receive the SCTE clock (typically from the DTE). The DCE then loops it back to the DTE as SCT and SCR. See Figure V24/35-12.

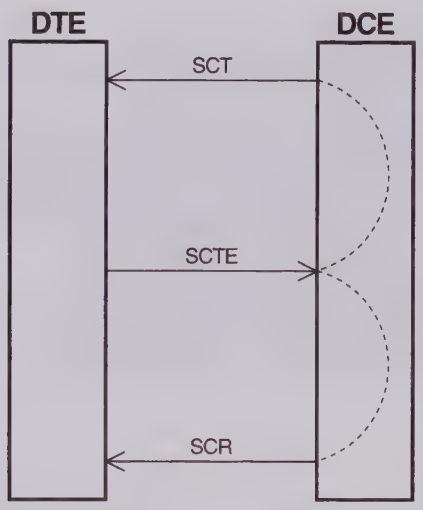


Figure V24/35-12 External Clocking for DCE or DTE Emulation

V24/35.4.1.5. Filename

When the Source is set to FILE, you enter the name of the logged data file. To see a list of available filenames to choose from, press F1 (view options). Use the cursor keys to highlight a filename and press Enter to load the file.

V24/35.4.1.6. Bits

This field allows you to select the number of bits per character. The options are:

- 8
- 7
- 6
- 5

The selections for 5, 6 and 7 bits are valid only for asynchronous transmission. Therefore, the Format setting (discussed later) should be ASYNC. This field is checked during program compilation. If BOP or SYNC is selected for Format, an error message will be displayed.

V24/35.4.1.7. Parity

This field allows you to select the type of parity error detection used. The options are:

- NONE – No parity checking.
- ODD – Odd parity is used. The combined data and parity bits should contain an odd number of ones.
- EVEN – Even parity is used. The combined data and parity bits should contain an even number of ones.
- MARK – Parity bit is always binary 1.
- SPACE – Parity bit is always binary 0.

This field defaults to NONE.

Note:

NONE is the only valid selection when 8 is the selected number of bits per character.

V24/35.4.1.8. Format

This field allows you to select the data format being used by the device or system under test. Press F1 (view options) to see the following choices:

- BOP – For devices using Bit-Oriented Synchronous Protocols that use 7E-framing and zero insertion. Examples of these protocols are HDLC and SDLC.
- SYNC – For devices using Character-Oriented Synchronous Protocols. Examples of these protocols are BSC (Binary Synchronous Communications or Bisync) and DDCMP (Digital Data Communications Message Protocol).

Note:

Only ANSI Bisync is supported – not IBM Bisync.

- ASYNC – For devices using an Asynchronous transmission format.

The Format field defaults to BOP. Move the cursor to the desired data format and press Enter to make your selection. Configuration screens for each of the above data formats can be accessed from the Format softkey rack by pressing either F3 (bop setup), F4 (sync setup) , or F5 (async setup). See Figure V24/35-13.

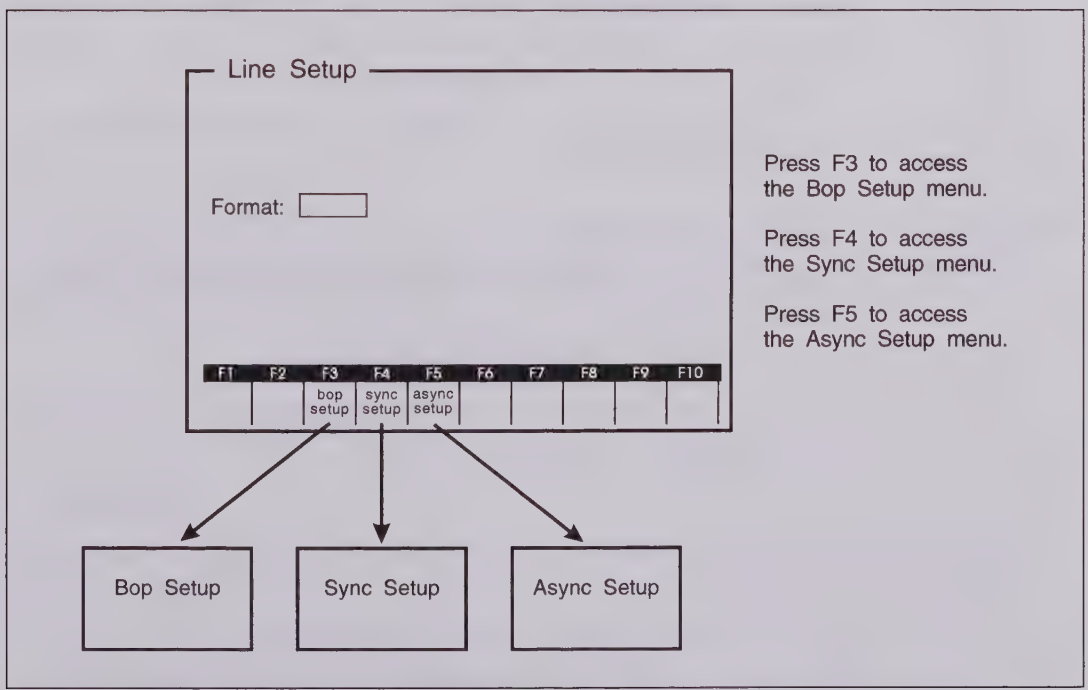

Line Setup
Format:
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
bop setup
sync setup
async setup
Press F3 to access the Bop Setup menu.
Press F4 to access the Sync Setup menu.
Press F5 to access the Async Setup menu.
Bop Setup
Sync Setup
Async Setup

Figure V24/35-13 Accessing Data Format Configuration Screens

V24/35.4.1.8.1. Bop Setup

Press F3 (bop setup) to change the default Bop settings shown in Figure V24/35-14.

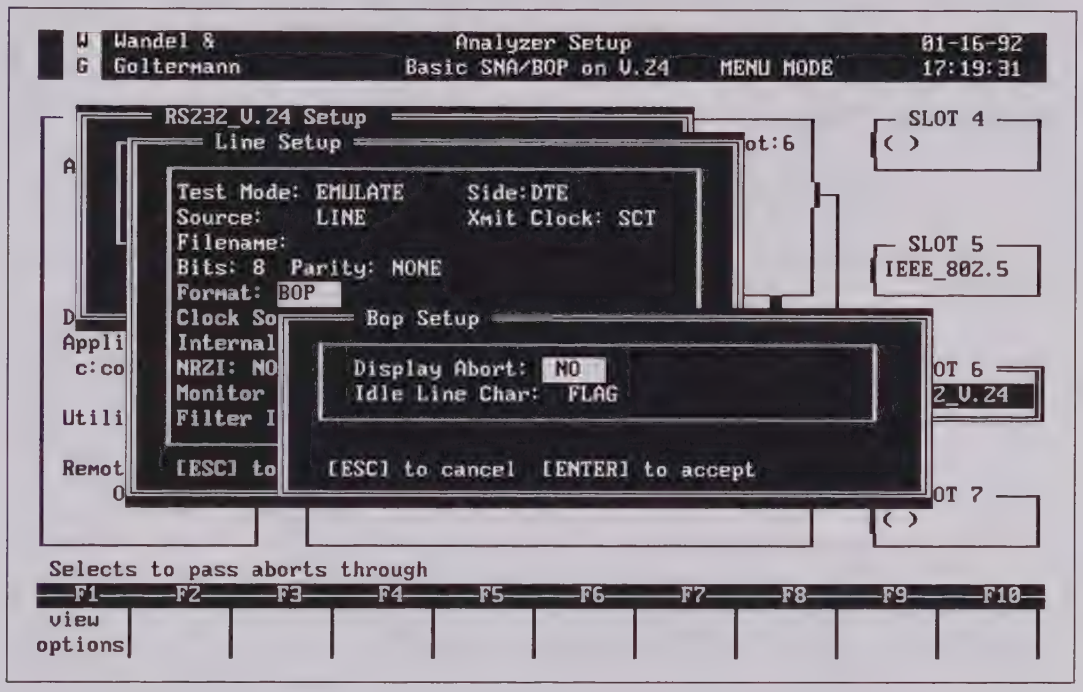


Figure V24/35-14 BOP Setup

V24/35.4.1.8.1.1 Display Abort

This field allows you to select whether or not Aborted frames trigger a specific event in the Network Event Program.

- NO
- YES

This field defaults to NO.

V24/35.4.1.8.1.2 Idle Line Character

This field allows you to select the character that the receiver interprets as an idle line (no data being transmitted).

- FLAG – Sets the Idle Line Character to 7E (hex).
- MARK – Sets the Idle Line Character to FF (hex).

The default Idle Line Character is FLAG (7E).

V24/35.4.1.8.2. Sync Setup

Press F4 (sync setup) to change the default Sync settings shown in Figure V24/35-15.

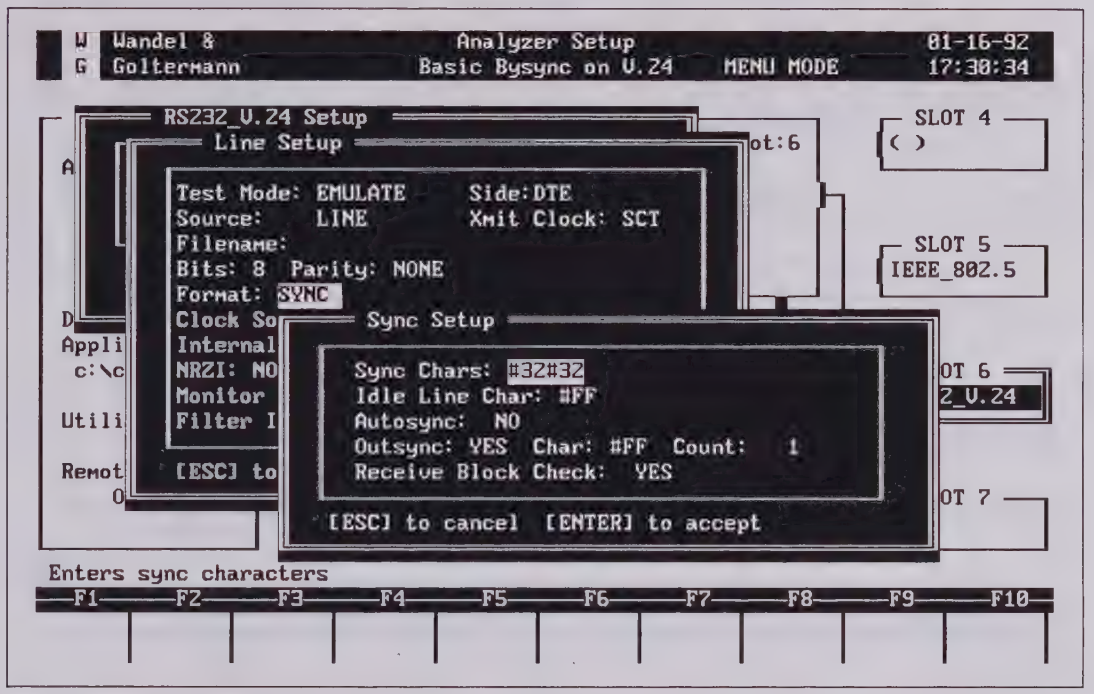


Figure V24/35-15 SYNC Setup

V24/35.4.1.8.2.1 Sync Characters

This field allows you to enter the hexadecimal characters the receiver uses to synchronize itself with the beginning of a frame. The format for this entry is:

#xx#xx where: # represents hexadecimal notation
xx is the character value

The default Synch Characters are #32#32.

V24/35.4.1.8.2.2 Idle Line Character

This field allow you to enter the Idle Line Character that is transmitted. This field is valid only when the Test Mode is set to Emulate. The format for this entry is:

#xx where: # represents hexadecimal notation;
xx is the character value

The default Idle Line Character is #FF.

V24/35.4.1.8.2.3 Autosync

This field allows you to select whether or not the receivers resynchronize each time the sync characters are detected.

- NO – The sync characters cause re-synchronization only if the receiver is out of sync.
- YES – Every occurrence of the sync characters causes re-synchronization.

This field defaults to NO.

V24/35.4.1.8.2.4 Outsync

This field allows you to select whether or not the receiver goes out of sync when it detects the Outsync character pattern.

- NO
- YES

This field defaults to YES.

V24/35.4.1.8.2.5 Character

This field allows you to select the character that the receiver interprets as the Outsync Character. The format is:

#xx where: # represents hexadecimal notation;
xx is the character value

The default Outsync Character is #FF.

V24/35.4.1.8.2.6 Count

This field determines the consecutive number of times the Outsync Character must be detected before the Outsync condition takes effect. The count can range from 1 to 999.

The default Outsync Count is 1.

V24/35.4.1.8.2.7 Receive Block Check

This field determines if CRC (Cyclic Redundancy Check) error detection is performed.

- NO – No CRC calculation is performed.
- YES – The receiver performs a CRC calculation according to the CRC Setup menu.

This field defaults to YES.

V24/35.4.1.8.3. Async Setup

Press F5 (async setup) to change the default Async settings. The Async Setup window is shown in Figure V24/35-16.

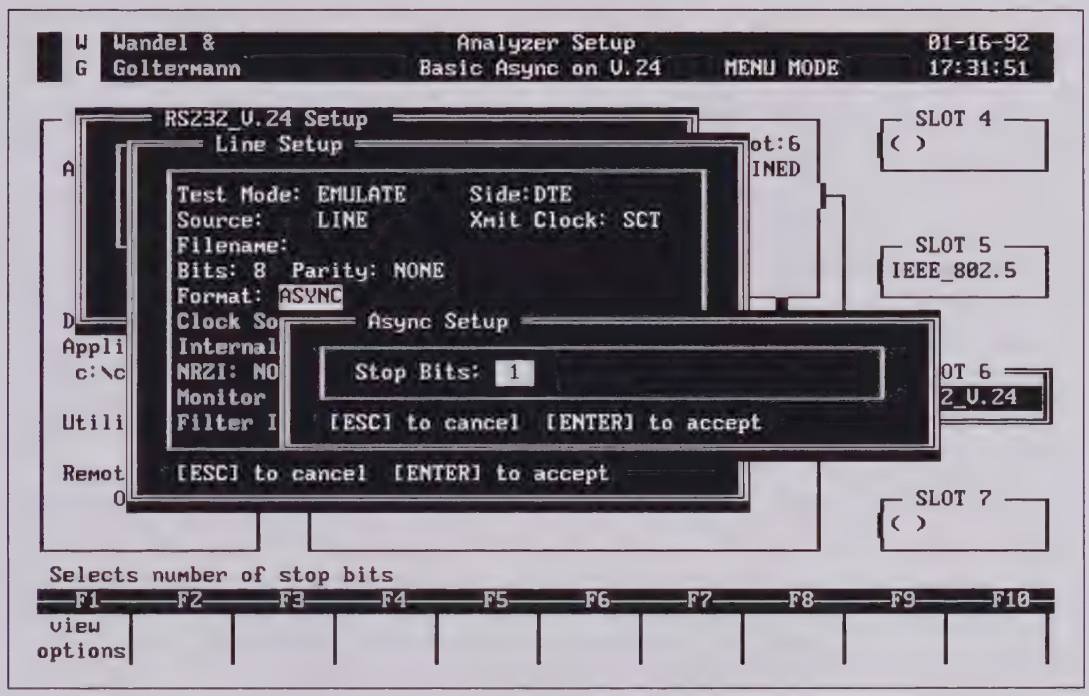


Figure V24/35-16 ASYNC Setup

V24/35.4.1.8.3.1 Stop Bits

This field allows you to select the minimum number of stop bits that terminate each data character. A stop bit is defined as a binary 1. The following choices are provided:

- 1 – Appends at least 1 stop bit at the end of each character.
- 2 – Appends at least 2 stop bits at the end of each character.

The default number of Stop Bits is 1.

The Stop Bits field, along with your selections for Bits and Parity, complete the asynchronous transmission setup. See Figure V24/35-17.

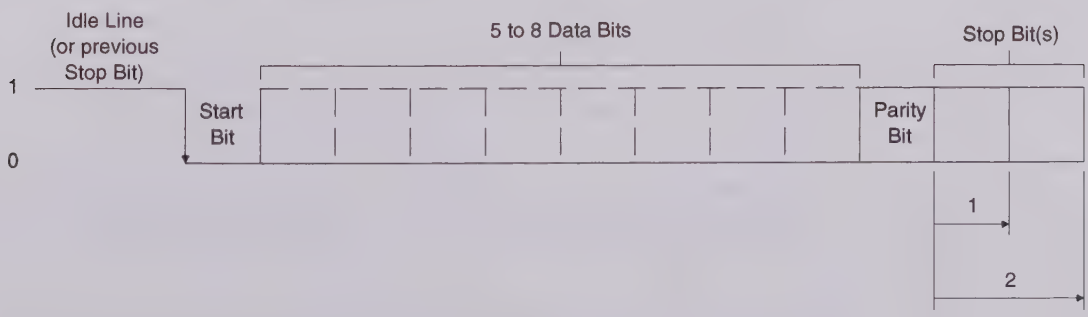


Figure V24/35-17 Asynchronous Transmission Format

The "Idle Line" state is also defined as a binary 1. When the transmitter is ready to send a character, it will send a start bit (binary 0) followed by the character (5 to 8 bits). It will then send a parity bit (if specified) and terminate transmission with the specified number of stop bits.

V24/35.4.1.9. Clock Source

- EXTERNAL – This setting is used when the DA-30 acts as a monitor between a DTE and a DCE – with the DA-30 clock being supplied by the DTE, DCE, or some other source.

  This setting can also be used when emulating a DTE or DCE. If emulating a DTE, the transmit and receive clocks (SCT & SCR) would typically be supplied by the DCE. If emulating a DCE, the transmit and receive clocks (SCT & SCR) are derived from an externally supplied transmit clock (SCTE). Be sure to set Xmit Clock to SCTE.

- INTERNAL – This setting is used when the DA-30 is emulating a DTE or DCE. If emulating a DTE, the DA-30 would provide the timing for the interface using the SCTE clock lead. The DCE uses SCTE to derive the transmit and receive clocks (SCT & SCR). If emulating a DCE, the DA-30 would provide the transmit and receive clocks (SCT & SCR) for the interface.

  This setting must be used whenever using the ASYNC data format. ASYNC means there is no clock on the interface leads and the DA-30 will not look for an external clock.

- INTERNAL SPLIT – This setting is used when you are monitoring or emulating a DCE in an asynchronous system where different baud rates are used for receive and transmit data. This setting can also be used when emulating a DCE on dual-speed, synchronous lines (SCT & SCR are clocked at different rates).

V24/35.4.1.10. Internal/DCE

This field allows you to enter the data line speed (in bits/sec) when the Test Mode is set to EMULATE.

- If the selected Clock Source is INTERNAL, this field is used to set the speed for both the SCR & SCT clocks when emulating a DCE. If emulating a DTE, it is used to set the speed for the SCTE clock. See Figure V24/35-18.

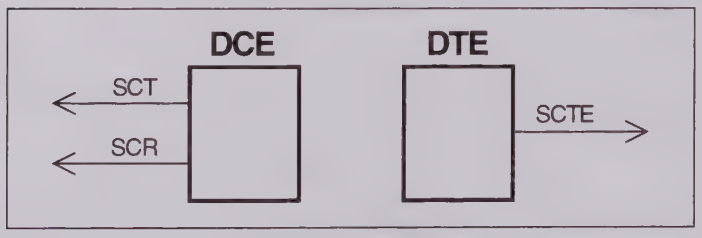


Figure V24/35-18 Setting Clock Rate for Internal Clock Source

- If the selected Clock Source is INTERNAL SPLIT, this field is used to set the speed for the SCR clock as shown in Figure V24/35-19. This field defaults to 2400 and is used only when emulating a DCE.

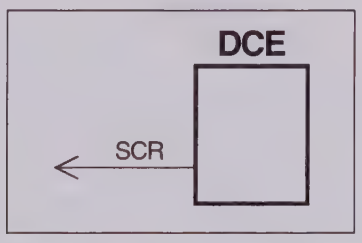


Figure V24/35-19 Setting Clock Rate for Internal Split Clock Source (DCE)

V24/35.4.1.11. DTE

This field allows you to enters the data line speed (in bits/sec) when the selected Mode is EMULATE.

- If the selected Clock Source is INTERNAL SPLIT, this rate is used only for the DTE side of the data line as shown in Figure V24/35-20. It is otherwise unused. This field defaults to 2400.

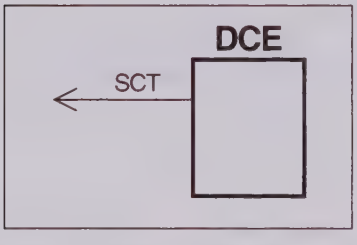


Figure V24/35-20 Setting Clock Rate for Internal Split Clock Source (DTE)

V24/35.4.1.12. NRZI – Non Return to Zero Inverted

This field allows you to select whether or not Non Return to Zero Inverted data encoding is performed.

- NO
- YES

In the NRZI encoding scheme, the line polarity is inverted with the transmission of each binary 0. The line polarity does not change, however, with the transmission of a binary 1. See Figure V24/35-21.

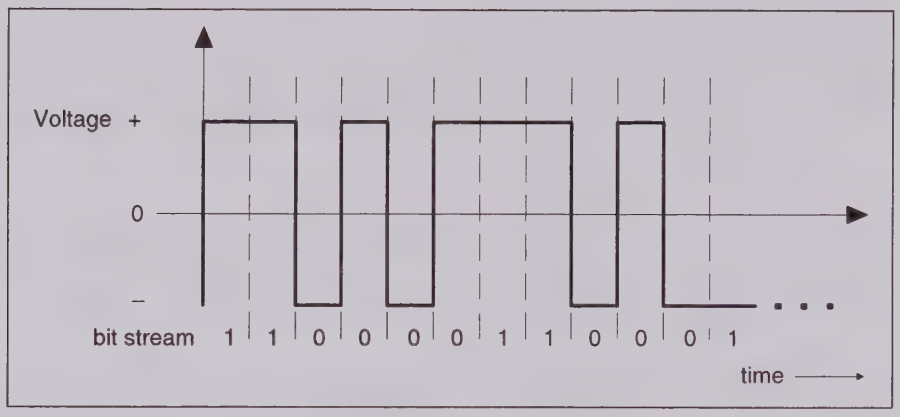


Figure V24/35-21 NRZI Encoding Example

This field defaults to NO.

V24/35.4.1.13. Mil-188C

This field allows you to select whether or not to invert the data signals (TD and RD).

- NO
- YES

This field defaults to NO.

V24/35.4.1.14. Slicing

Frame Slicing allows you to shorten a data frame before it is passed to the protocol analyzer for processing. This is useful when you are only interested in certain parts of a frame (i.e frame headers). Frame slicing is not valid when using the ASYNC data format.

- NONE – The entire frame is passed.
- 32 – Only the first 32 bytes of a frame are passed.
- 64 – Only the first 64 bytes of a frame are passed.
- 128 – Only the first 128 bytes of a frame are passed.
- 256 – Only the first 256 bytes of a frame are passed.
- 512 – Only the first 512 bytes of a frame are passed.
- 1024 – Only the first 1024 bytes of a frame are passed.

Frame slicing also allows you to maximize the amount of protocol information that is written to the capture buffer or to the hard disk (when logging). Although no data beyond the specified size is passed to the protocol analyzer, CRC checking is performed for the entire frame.

Note:

Be careful not to slice a frame in the middle of a protocol header – making the protocol invalid for decoding.

This field defaults to NONE.

V24/35.4.1.15. Monitor Leads

This field allows you to monitor the activity of the data and control leads (TD, RD, RTS, CTS, CD, DSR, DTR). During Run Mode, the waveform for each control lead is displayed on the Network Status screen.

- NO – The control leads are not monitored.
- YES – The control leads are monitored.

This field defaults to NO.

V24/35.4.1.16. Handshake Leads

This field allows you to select whether or not control lead handshaking is to be performed when the selected Test Mode is EMULATE. The control leads must be set to ON or SWITCHED in the Control Lead Setup menu.

- NO – No control lead handshaking is performed during data transmission.
- YES – Control lead handshaking is performed based on the settings on the Control Lead Setup menu and the selected Side (DTE or DCE) of the interface that is being emulated. A warning is displayed if there is an invalid control lead setting.

This field defaults to YES.

V24/35.4.1.17. Filter In

The received data that is processed by the analyzer can come from either or both sides of the interface. This field allows you to make that selection. Press F1 (view options) for the following choices:

- BOTH – Signals from both the DTE and the DCE sides of the interface are passed to the analyzer for processing.
- DTE – Only signals from the DTE side of the interface are passed up to the analyzer for processing.
- DCE – Only signals from the DCE side of the interface are passed up to the analyzer for processing.

This field defaults to BOTH.

V24/35.4.2. Control Lead Setup

From the Top Level setup screen, move the cursor to Control Lead Setup and press F2 (lead options) to see the Control Lead Setup menu shown in Figure V24/35-22.

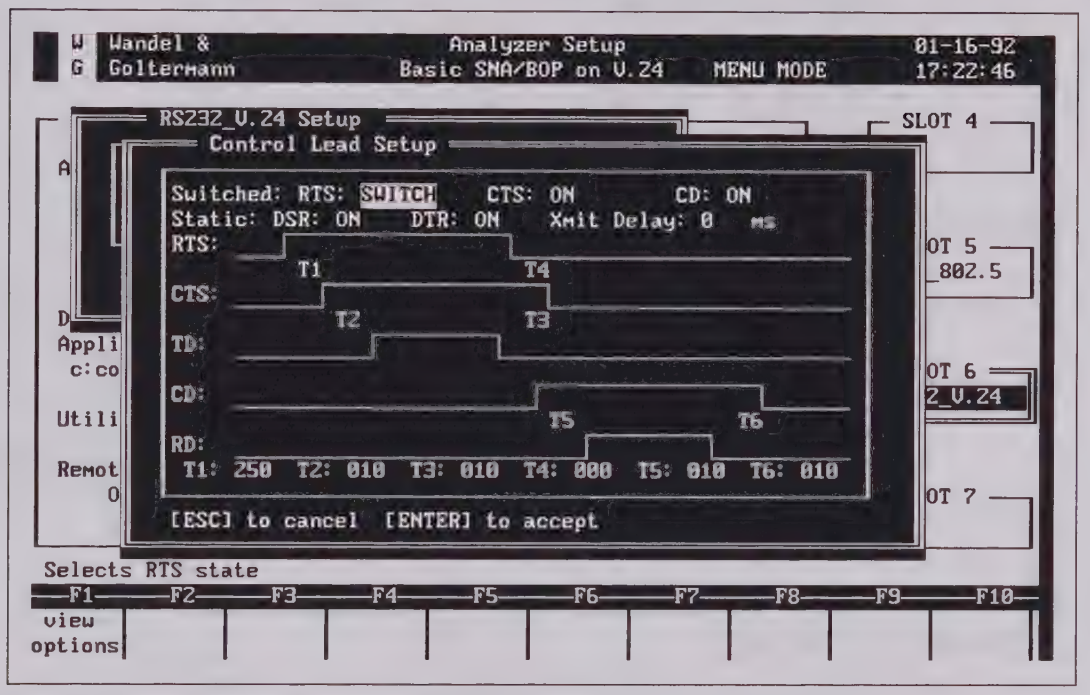


Figure V24/35-22 Control Lead Setup

The Control Lead Setup menu allows you to configure the initial state of the control leads as well as set the timing relationships between them.

These settings are used only when the Test Mode (on the Line Setup menu) is set to EMULATE.

V24/35.4.2.1. Switched RTS (Request To Send)

This field allows you to select how the RTS control lead behaves during Run Mode. The RTS lead can be controlled only when emulating a DTE.

OFF – The lead is driven LOW. If emulating a DCE, the DA-30 turns CD ON to transmit without waiting for CTS OFF.

ON – The lead is driven HIGH. If emulating a DCE, the DA-30 turns CD ON to transmit without waiting for CTS OFF.

SWITCH – The lead is turned ON and OFF under the control of the LIP. The initial state is OFF. The DA-30 waits for CTS ON before transmitting (on TD). RTS is turned ON before each transmission and is turned OFF at the end of each transmission. The DA-30 will wait for CTS OFF before turning RTS ON for a new transmission.

If emulating a DCE (and CTS & CD are SWITCHed), the DA-30 will wait for CTS OFF before turning CD ON to transmit.

> You may specify a delay that the DA-30 waits before turning RTS ON after test conditions have been satisfied. See the Xmit Delay field.
>
> You may also specify the delay that the DA-30 waits before turning RTS OFF at the end of transmission. See the T3 field.

V24/35.4.2.2. Switched CTS (Clear To Send)

This field allows you to select how the CTS control lead behaves during Run Mode. The CTS lead can be controlled only when emulating a DCE.

- OFF – The lead is driven LOW. If emulating a DTE, the DA-30 will transmit (on TD)--ignoring the CTS OFF condition.
- ON – The lead is driven HIGH. If emulating a DTE, the DA-30 will transmit (on TD) without waiting for CTS ON.
- SWITCH – The lead is turned ON and OFF under the control of the LIP. The initial state is OFF. If emulating a DTE, the DA-30 will wait for CTS ON before transmitting (on TD).

  You may specify a delay that the DA-30 waits before turning CTS ON after detecting RTS ON. See the T1 field.

  You may also specify a delay that the DA-30 waits before turning CTS OFF after detecting RTS OFF. See the T4 field.

V24/35.4.2.3. Switched CD (Carrier Detect)

This field allows you to select how the CD control lead behaves during Run Mode. The CD lead can be controlled only when emulating a DCE.

- OFF – The lead is driven LOW. If emulating a DTE, the DA-30 will turn RTS ON for a new transmission without waiting for CTS OFF.
- ON – The lead is driven HIGH. If emulating a DTE, the DA-30 will turn RTS ON for a new transmission without waiting for CTS OFF.
- SWITCH – The lead is turned ON and OFF under the control of the LIP. The initial state is OFF. If CTS is ON (in response to RTS ON), CD will not be turned ON until CTS goes OFF. If emulating a DTE, the DA-30 will wait for CTS OFF before turning RTS ON for a new transmission.

  You may specify a delay that the DA-30 waits before turning CD ON after test conditions have been satisfied. See the Xmit Delay field.

  You may also specify a delay that the DA-30 waits before transmitting data (on RD) after turning CD ON. See the T5 field.

  You may also specify a delay that the DA-30 waits before turning CD OFF at the end of transmission. See the T6 field.

V24/35.4.2.4. Static DSR (Data Set Ready)

This field allows you to select how the DSR control lead behaves during Run Mode. The DSR lead can be controlled only when emulating a DCE.

- ON – The lead is driven HIGH.
- OFF – The lead is driven LOW.

This field defaults to ON.

V24/35.4.2.5. Static DTR (Data Terminal Ready)

This field allows you to select how the DTR control lead behaves during Run Mode. The DTR lead can be controlled only when emulating a DTE.

- ON – The lead is driven HIGH.
- OFF – The lead is driven LOW.

This field defaults to ON.

V24/35.4.2.6. Xmit Delay

This field allows you to set the delay (in milliseconds) between the time the DA-30 becomes ready to transmit (generate or playback) and the time it indicates its readiness to transmit (by raising the appropriate control lead). See Figure V24/35-23.

- When emulating DTE, the RTS lead is driven HIGH.
- When emulating DCE, the CD lead is driven HIGH.

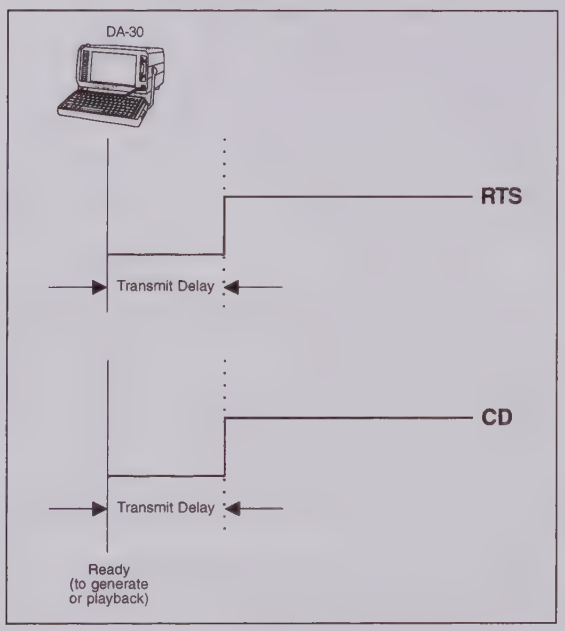


Figure V24/35-23 Transmit Delay

The delay can range from 0 to 999 milliseconds and defaults to 0 ms.

V24/35.4.2.7. T1

This field allows you to set the amount of time (in milliseconds) that the DA-30 will wait before turning CTS ON after detecting RTS ON. This delay applies only when emulating a DCE.

The delay can range from 0 to 999 milliseconds and defaults to 250 ms.

V24/35.4.2.8. T2

This field allows you to set the amount of time (in milliseconds) that the DA-30 will wait before transmitting (on TD) after detecting CTS ON. This field applies only when emulating a DTE.

The delay can range from 0 to 999 milliseconds and defaults to 10 ms.

V24/35.4.2.9. T3

This field allows you to set the amount of time (in milliseconds) that the DA-30 will wait before turning RTS OFF after it has stopped transmitting. This field applies only when emulating a DTE.

The delay can range from 0 to 999 milliseconds and defaults to 10 ms.

V24/35.4.2.10. T4

This field allows you to set the amount of time (in milliseconds) that the DA-30 will wait before turning CTS OFF after detecting RTS OFF. This field applies only when emulating a DCE.

The delay can range from 0 to 999 milliseconds and defaults to 0 ms.

V24/35.4.2.11. T5

This field allows you to set the amount of time (in milliseconds) that the DA-30 will wait before transmitting (on RD) after turning CD ON. This field applies only when emulating a DCE.

The delay can range from 0 to 999 milliseconds and defaults to 10 ms.

V24/35.4.2.12. T6

This field allows you to set the amount of time (in milliseconds) that the DA-30 will wait before turning CD OFF after it has stopped transmitting. This field applies only when emulating a DCE.

The delay can range from 0 to 999 milliseconds and defaults to 10 ms.

V24/35.4.3. CRC (Cyclical Redundancy Check) Setup

From the Top Level setup screen, move the cursor to CRC Setup and press F2 (crc options) to see the CRC Setup screen shown in Figure V24/35-24.

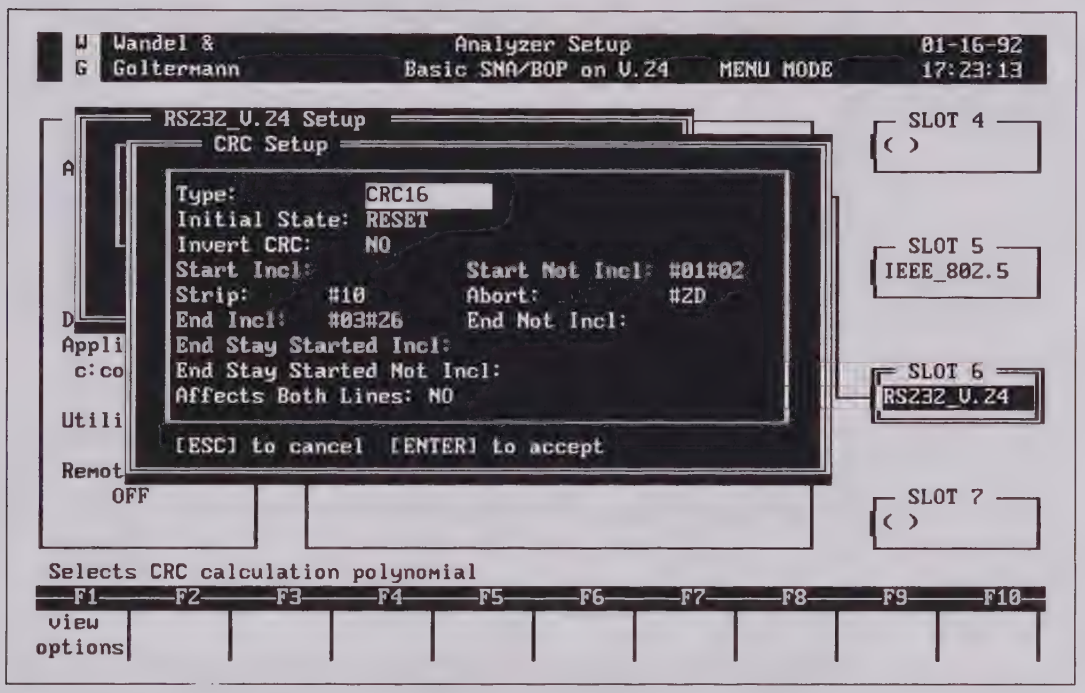


Figure V24/35-24 CRC Setup

The CRC calculator has a Start state and an Accumulate state. In the Start state, the calculator waits for the character that starts the calculation. In the Accumulate state, the calculator performs the calculation according to the CRC polynomial.

The calculator changes from the Start state to the Accumulate state on the first Start character it detects. Subsequent Start characters that are detected – once in the Accumulate state – are treated as normal characters in the data stream. When an End character is detected, the calculation stops, and the CRC calculator compares its calculation to the frame's transmitted FCS value. Based on this comparison, the frame is then evaluated as Good or Bad. The calculator then returns to the Start state.

The CRC calculator is used for the ANSI Bisync protocol only. Therefore, the CRC Setup screen defaults to an ANSI Bisync CRC check. So, when using the CRC calculator, be sure to set Format to SYNC on the Line Setup menu.

The ANSI Bisync default settings and their explanations are shown in Table 3.

FIELD	DEFAULT	EXPLANATION
Type	CRC16	The $x^{16} + x^{15} + x^2 + 1$ polynomial is used.
Initial State	RESET	The CRC is initially set to all zeros.
Invert CRC	NO	The polarity of the CRC is unchanged.
Start Incl	Blank	N/A
Start Not Incl	#01#02 (See Note)	The occurrence of **either** of these characters (01 or 02) in the data stream triggers the CRC calculation on the received frame. They are not included in the CRC calculation.
Strip	#10 (See Note)	This character is excluded (Stripped) from the CRC calculation.
Abort	#2D (See Note)	This character causes the CRC calculator to abort the current calculation. The current frame is then flagged as an aborted frame, and the calculator returns to the Start state.
End Incl	#03#26 (See Note)	The occurrence of **either** of these characters (03 or 26) in the data stream triggers the end of the CRC calculation. These characters are included in the CRC calculation. The CRC calculator then compares its calculation to the frame's FCS value. Based on this comparison, the frame is then evaluated as Good or Bad, and the calculator returns to the Start state.
End Not Incl	Blank	N/A
End Stay Started Incl	Blank	N/A
End Stay Started Not Incl	Blank	N/A
Affects Both Lines	NO	When an Abort character is detected, the CRC calculation aborts only the side (DTE or DCE) of the data line that generated the Abort.

Note: # denotes hexadecimal notation.

Table 3 Default CRC Settings

V24/35.5. TESTPREP Consistency Check

After you have the completed the interface setup (Line Setup, Control Lead Setup, and CRC Setup) and returned to the Main menu, you can run your current application by going to the Run Mode (press the Alt-Run keys). Before going from the Menu Mode to the Run Mode, the DA-30 runs a program called TESTPREP that checks to see if all your setup entries are consistent before compiling and running your application. If you have inadvertently created an inconsistent setup, TESTPREP flags the problem. A warning message will appear offering you the option of returning to Menu Mode to correct the inconsistent settings or allowing the DA-30 to change them for you. See Figure V24/35-25. If you choose the latter, the change takes effect in Run Mode only; that is, the menu selection is not physically altered. Running the application again without making the necessary correction(s) in the setup menus produces the same results. Therefore, upon seeing the warning message, you may wish to return to Menu Mode, correct the inconsistency, and save the application before running again.

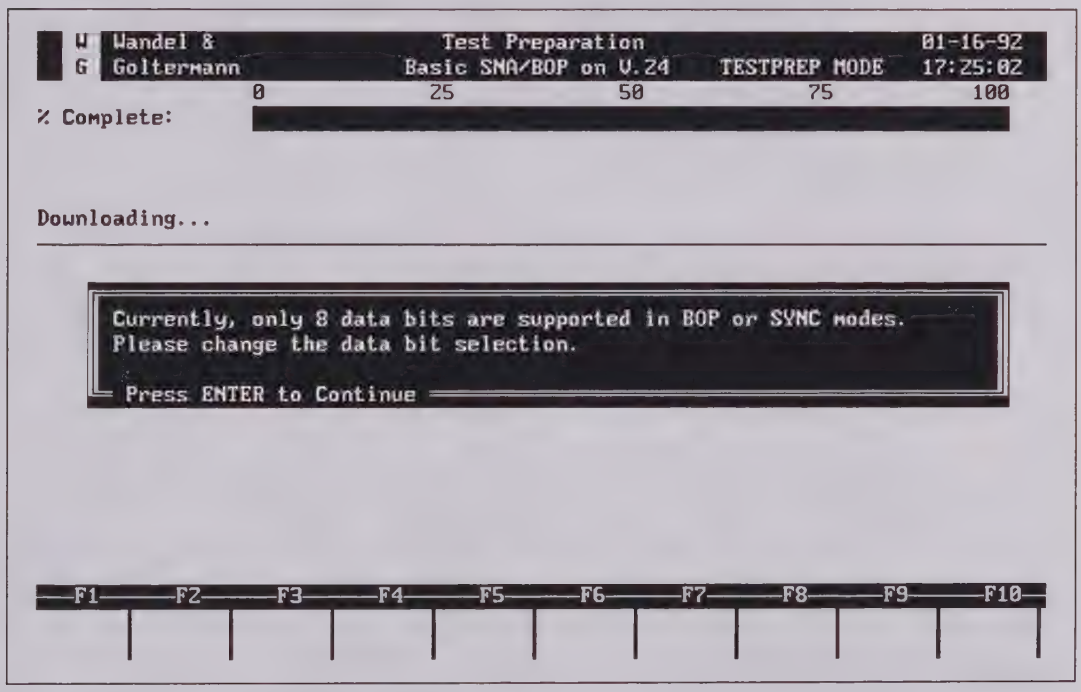


Figure V24/35-25 TESTPREP Warning

V24/35.6. Front Panel LEDs

There are 12 front panel LEDs. Eleven of these indicate the status of a corresponding pin (interchange circuit) on the RS-232/V.24 or V.35 interface. A twelfth LED is provided to indicate the status of one of the two Auxiliary I/O pins (AUX 1 & AUX 2) on the rear panel. An LED overlay is used to associate each LED with a particular interface pin. See Figure V24/35-26.

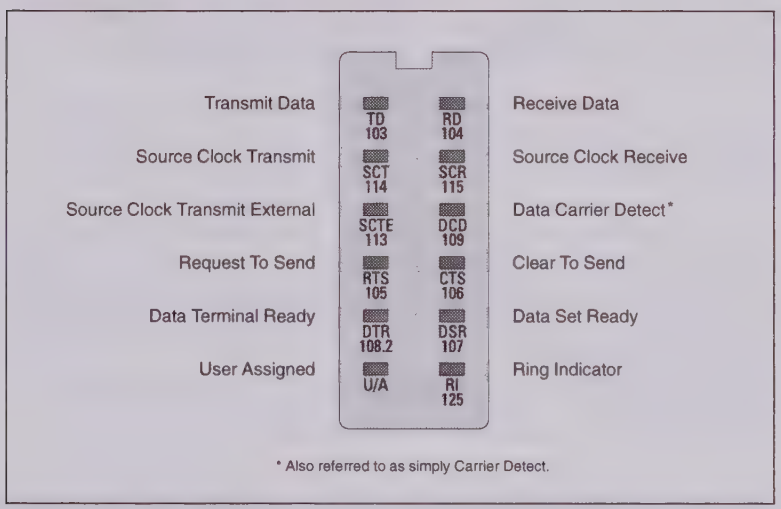


Figure V24/35-26 LED Overlay (with Labels) for RS-232C/V.24 & V.35

Underneath each LED, there is a standard circuit abbreviation and CCITT interface circuit number (not pin number).

The status of the individual interface pins is indicated by the color of their respective LEDs. If no signal is present on a pin, or if the signal floats between binary 1 and binary 0, the corresponding LED will be OFF. If a pin is driven HIGH (binary 0), its LED will be RED. If a pin is driven LOW (binary 1), its LED will be GREEN. If a pin is rapidly alternating between binary 1 and binary 0, its LED will be ORANGE (steady or flickering). See Table 4.

LED Color	Pin Status
OFF	No Signal; or Floating
RED	High; Binary 0 (Space)
GREEN	Low; Binary 1 (Mark)
ORANGE	Alternating between High & Low

Table 4 Front Panel LED Color Indication

Note:

For V.35 Line Interface Modules marked Series L (or later), each interface pin should be terminated to a live network. If not, the corresponding front panel LED may incorrectly indicate the state of that interchange circuit. The diagnostic capabilities of the DA-30, however, are not affected.

V24/35.7. Viewing Results in Run Mode

The RS-232/V.24 and V.35 Line Interface software (LIP) offers two basic screens for displaying results in the Run Mode. These are the Network Status and Character Trace screens. Either of these screens may be displayed automatically upon entering the Run Mode by selecting it for the initial Run Mode display. This is described in the Initial Displays section of the "Applications" chapter in the *DA-30/31 Operating Manual*.

If higher-layer protocol packages are loaded and active in the current application, you can also access the Protocol Trace screens by pressing F3 (protocol traces) from the Run Mode Top Rack.

V24/35.7.1. Network Status Screen

To access the Network Status screen, press F1 (NETWORK STATUS) from the Run Mode Top Rack. The Network Status screen that appears when using synchronous data formats (BOP or SYNC) differs from the one that appears when using asynchronous data formats (ASYNC).

When Using BOP or SYNC:

The Network Status screen that appears when using the BOP or SYNC data format is shown in Figure V24/35-27.

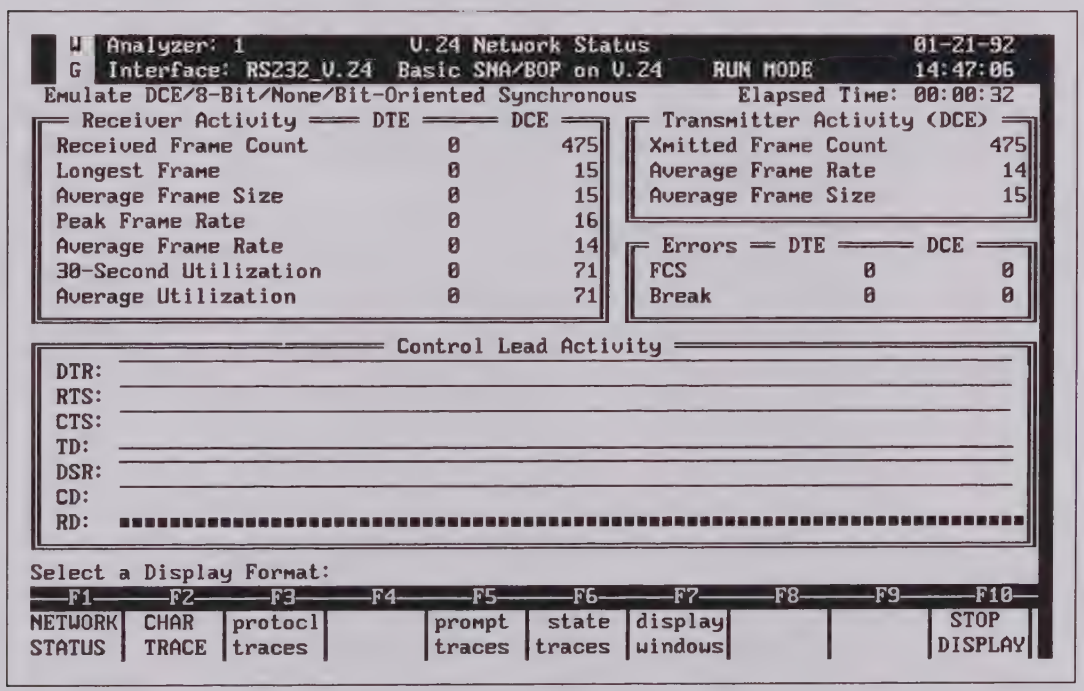


Figure V24/35-27 RUN MODE Network Status Screen (BOP or SYNC)

The first line of this screen summarizes the Line Setup settings. The current Test Mode, number of Bits per character, type of Parity used (if any), and the Format (transmission technique) used for the data are all listed as follows:

Test Mode/Bits/Parity/Format

The first line also contains an Elapsed Time counter that reports the time that elapsed since the current application started running. The rest of the screen is subdivided into four sections that detail the Receiver Activity, Transmitter Activity, Errors and Control Lead Activity.

V24/35.7.1.1. Receiver (or Playback) Activity

The name of this section depends on the Source selection on the Line Setup menu. If the data being analyzed comes from the Line, this section is labelled Receiver Activity. If the data comes from a logged data file, this section is labelled Playback Activity.

> **Note:**
>
> Because the log file structures for BOP, SYNC and ASYNC data formats are unique, only playback log files using the data format in which they were created. Otherwise, you may get unpredictable results.

This section is further partitioned into two columns. One for the DTE side of the interface and one for the DCE side. For each side of the interface, the following information is reported:

- Received Frame Count – the current number of frames received.
- Longest Frame – the size (in bytes) of the longest frame that has been received since receiving began.
- Average Frame Size – the current average size (in bytes) of the received frames since receiving began.
- Peak Frame Rate – the highest frame rate (Frames per second) detected at the receiver.
- Average Frame Rate – the current average frame rate (Frames per second).
- 30-Second Utilization – the average utilization (%) for the past 30-second interval. This field is updated every 30 seconds.
- Average Utilization – the average utilization (%) since receiving began.

> **Note:**
>
> Currently, the 30-Second Utilization and Average Utilization fields are supported only when the Clock Source is set to Internal. Otherwise, these fields will display "Unavail".

V24/35.7.1.2. Transmitter Activity ( )

Depending on the Test Mode, the area inside the parentheses, ( ), will contain one of the following designations:

MON. When MONITOR is the selected Test Mode.

DTE. When EMULATE is the selected Test Mode and DTE is the selected Side.

DCE. When EMULATE is the selected Test Mode and DCE is the selected Side.

Whether emulating a DTE or DCE, this section reports the following information:

- Transmitted Frame Count – the current number of frames that have been transmitted.
- Average Frame Rate – the current average rate (Frames per second) at which frames are being transmitted.
- Average Frame Size – the current average size (in bytes) of the transmitted frames since transmission began.

V24/35.7.1.3. Errors

This section is also partitioned into a DTE column and a DCE column. For each side of the interface, the following counters report the number of errors detected by the receiver:

- FCS – this counter is incremented each time a Frame Check Sequence (CRC) error occurs.
- Break – this counter is incremented each time a Break or Abort occurs. Depending on the data format being used, the counter value represents the number of Breaks or Aborts that have occurred. See Table 5.

Error Type	Data Format	Error Condition
Abort	BOP	Seven consecutive ones occurs in data stream.
Abort	SYNC	The specified Abort character appears in the data stream when the Block Check is calculated. -or- The receiver goes out of sync – due to the Outsync character being detected for the specified number (Outsync Count) of times.
Break	ASYNC	Consecutive zeros occurring for Start, Data, & optional Parity bits.

Table 5 Type of Errors Reported by the Break Counter

V24/35.7.1.4. Control Lead Activity

This section of the screen graphically displays the waveforms for the transmit data (TD), receive data (RD), and control leads (DTR, RTS, CTS, DSR and CD). This allows you to examine their timing relationships. These waveforms reflect the settings on the Control Lead Setup menu. A fill-in character (▮) is used to indicate data activity on the TD and RD lines. An underscore (_)represents inactivity.

This section of the screen is enabled only when YES is selected for Monitor Leads on the Line Setup menu. It is otherwise left blank. It is also blank whenever playing back data from a logged file.

When Using ASYNC:

When using asynchronous data formats, the Network Status screen appears as shown in Figure V24/35-28.

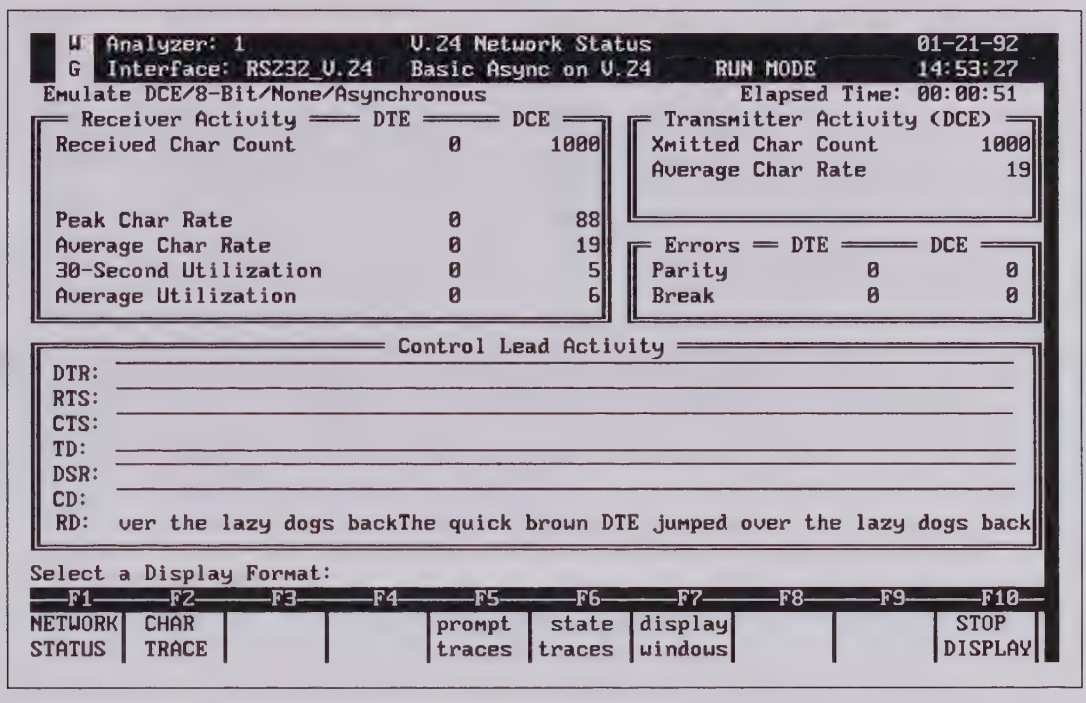


Figure V24/35-28 RUN MODE Network Status Screen (ASYNC)

Since the basic unit of asynchronous transmission is the character , the word “Frame” is replaced by “Char” in all of the fields in the Receiver Activity and Transmitter Activity sections of the screen. Moreover, those fields that have only to do with frames have been removed (i.e. Longest Frame, Average Frame Size).

Instead of using the fill-in character to represent data activity, in the Control Lead Activity section, the TD and RD lines show the actual characters being transmitted/received.

V24/35.7.2. Character Trace Screen

To access the Character Trace screen, press F2 (CHAR TRACE) from the Run Mode Top Rack. The Character Trace screen that appears when using synchronous data formats (BOP or SYNC) differs from the one that appears when using asynchronous data formats (ASYNC).

When Using BOP or SYNC:

The Character Trace screen that appears when using the BOP or SYNC format is shown in Figure V24/35-29.

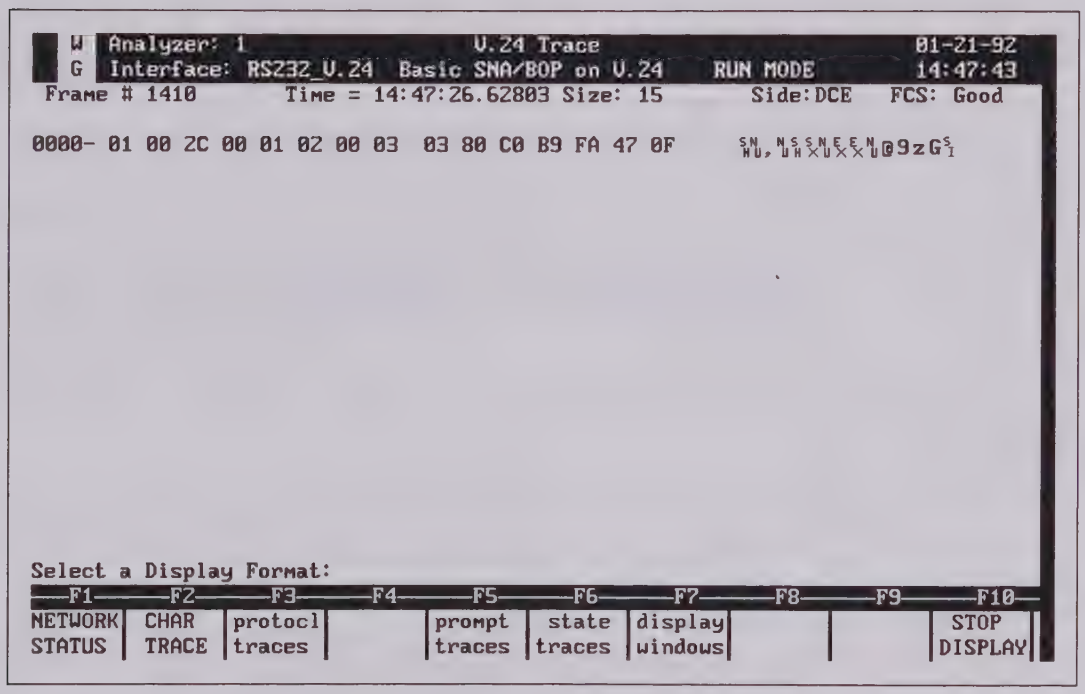

Analyzer: 1 V.24 Trace 01-21-92
Interface: RS232_V.24 Basic SNA/BOP on V.24 RUN MODE 14:47:43
Frame # 1410 Time = 14:47:26.62803 Size: 15 Side:DCE FCS: Good
0000- 01 00 2C 00 01 02 00 03 03 80 C0 B9 FA 47 0F
Select a Display Format:
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
NETWORK STATUS
CHAR TRACE
protocl traces
prompt traces
state traces
display windows
STOP DISPLAY

Figure V24/35-29 RUN MODE Character Trace Screen (BOP or SYNC)

For each frame that is received, the first line of this screen shows the number of the frame, the time it was received, its size (in bytes), the side of the line that is being monitored, and the result of the FCS (CRC) evaluation. The rest of the screen displays the frame data in hexadecimal representation (on left) and in the character representation (on right). The character code used depends on the Character Code setting on the Display Setup menu – accessed via the analyzer window's Initial Display field.

When Using ASYNC:

The Character Trace screen that appears when using the ASYNC data format is shown in Figure V24/35-30.

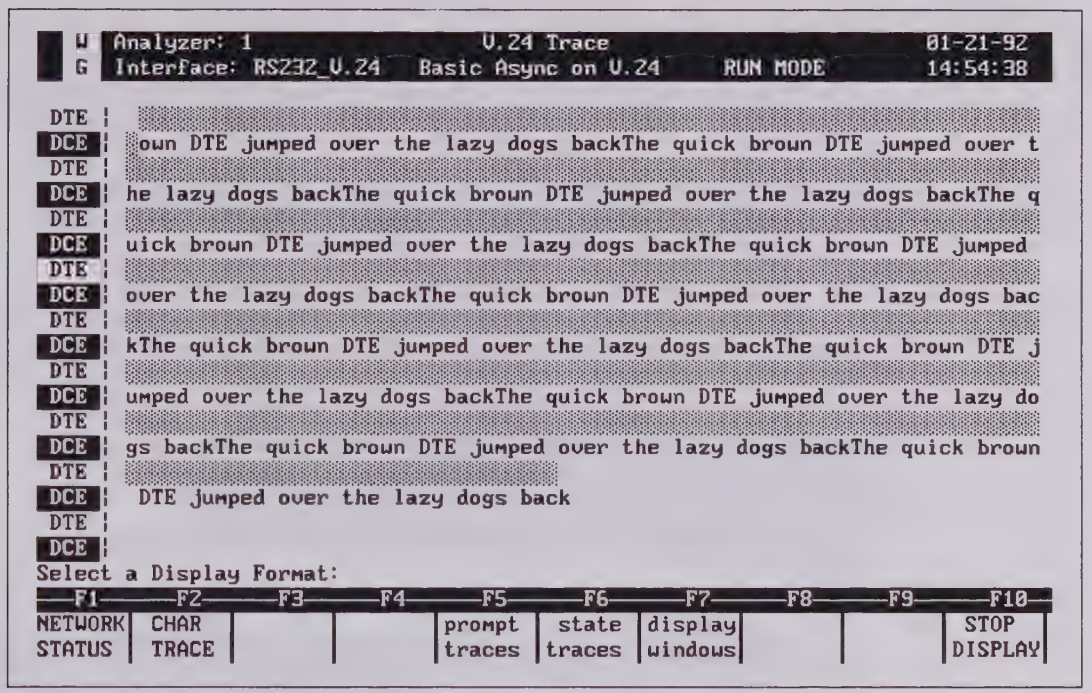

Analyzer: 1 V.24 Trace 01-21-92
Interface: RS232_V.24 Basic Async on V.24 RUN MODE 14:54:38
DTE
DCE own DTE jumped over the lazy dogs backThe quick broun DTE jumped over t
DTE
DCE he lazy dogs backThe quick broun DTE jumped over the lazy dogs backThe q
DTE
DCE uick brown DTE jumped over the lazy dogs backThe quick brown DTE jumped
DTE
DCE over the lazy dogs backThe quick brown DTE jumped over the lazy dogs bac
DTE
DCE kThe quick broun DTE jumped over the lazy dogs backThe quick brown DTE j
DTE
DCE umped over the lazy dogs backThe quick brown DTE jumped over the lazy do
DTE
DCE gs backThe quick broun DTE jumped over the lazy dogs backThe quick brown
DTE
DCE DTE jumped over the lazy dogs back
DTE
DCE
Select a Display Format:
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
NETWORK STATUS
CHAR TRACE
prompt traces
state traces
display windows
STOP DISPLAY

Figure V24/35-30 RUN MODE Character Trace Screen (ASYNC)

This screen displays character data in a Data Line Monitor format. Each line of the display alternates between the DTE and the DCE. Each line is appropriately labelled DTE or DCE. Moreover, the word DCE is highlighted to help distinguish DTE data from DCE data.

V24/35.8. Viewing Results in the Examine Mode

The RS-232/V.24 and V.35 Line Interface software offers the same two basic screens for examining a capture file in the Examine Mode as those described in the Run mode. Either of these screens may be displayed automatically upon entering the Examine Mode by selecting it for the initial Examine Mode display. This is described in the Initial Displays section of the "Applications" chapter in the *DA-30/31 Operating Manual*.

Note:

Because the data framing for BOP, SYNC and ASYNC are unique, you should only Examine capture files using the data format in which they were created. Otherwise, you may get unpredictable results.

V24/35.8.1. Network Status Screen

To access the Network Status screen, press F1 (NETWORK STATUS) from the Examine Mode Top Rack. This screen is identical to the Run Mode Network Status screen for each of the data formats (BOP, SYNC and ASYNC).

V24/35.8.2. Character Trace Screen

The Character Trace screen that appears when using synchronous data formats (BOP or SYNC) differs from the one that appears when using asynchronous data formats (ASYNC).

When Using BOP or SYNC:

When using the BOP or SYNC data format, the Character Trace screen looks just like the one described in Run Mode. If there are higher-level protocol packages loaded and running, you can display their traces by pressing F3 (protocol traces) from the Exam Mode Top Rack. You can then selectively display frames based on multiple (core & protocol-specific) criteria by pressing F8 (display filters). You can also access the Frame Detail screen by pressing F9 (FRAME DETAIL) from the protocol traces softkey rack. The core find commands, as well as any other protocol-specific find commands, are available by pressing F10 (find command) from either the character or protocol trace softkey rack.

When Using ASYNC:

When using the ASYNC data format, the Character Trace that appears is shown in Figure V24/35-31.

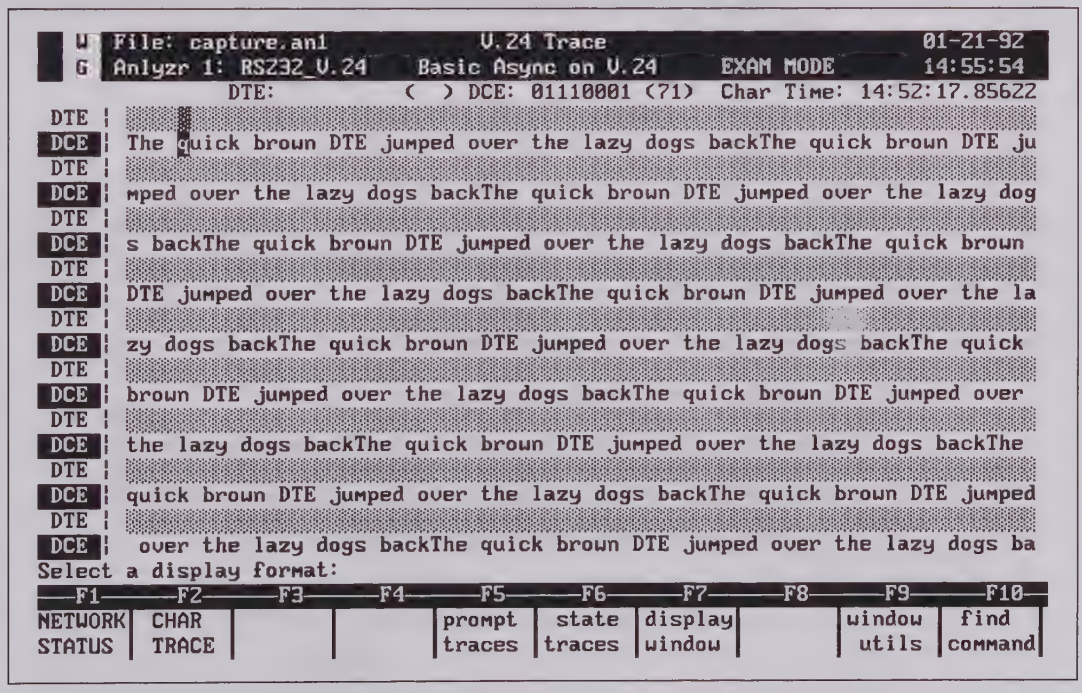

File: capture.ani V.24 Trace 01-21-92
Anlyzr 1: RS232_V.24 Basic Async on V.24 EXAM MODE 14:55:54
DTE: ( ) DCE: 01110001 (71) Char Time: 14:52:17.85622
DTE
DCE The quick brown DTE jumped over the lazy dogs backThe quick brown DTE ju
DTE
DCE mped over the lazy dogs backThe quick brown DTE jumped over the lazy dog
DTE
DCE s backThe quick brown DTE jumped over the lazy dogs backThe quick brown
DTE
DCE DTE jumped over the lazy dogs backThe quick brown DTE jumped over the la
DTE
DCE zy dogs backThe quick brown DTE jumped over the lazy dogs backThe quick
DTE
DCE brown DTE jumped over the lazy dogs backThe quick brown DTE jumped over
DTE
DCE the lazy dogs backThe quick brown DTE jumped over the lazy dogs backThe
DTE
DCE quick brown DTE jumped over the lazy dogs backThe quick brown DTE jumped
DTE
DCE over the lazy dogs backThe quick brown DTE jumped over the lazy dogs ba
Select a display format:
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
NETWORK STATUS
CHAR TRACE
prompt traces
state traces
display window
window utils
find command

Figure V24/35-31 EXAM MODE Character Trace Screen (ASYNC)

This screen is identical to the Character Trace described for the Run Mode except for the first line. Displayed on the first line of this screen is the binary and hexadecimal representations of the characters located at the cursor position. The cursor highlights two character time slots at a time – one for the DTE and one for the DCE.

Note:

The Character Trace for ASYNC is available only if the RS-232C/V.24 or V.35 LIP was loaded when the capture file was created.

No display filters or find commands (core or protocol-specific) are available for capture files created while using the ASYNC data format. Moreover, Frame Detail is not allowed. If the Frame Detail softkey is pressed, the error message shown in Figure V24/35-32 will be displayed.

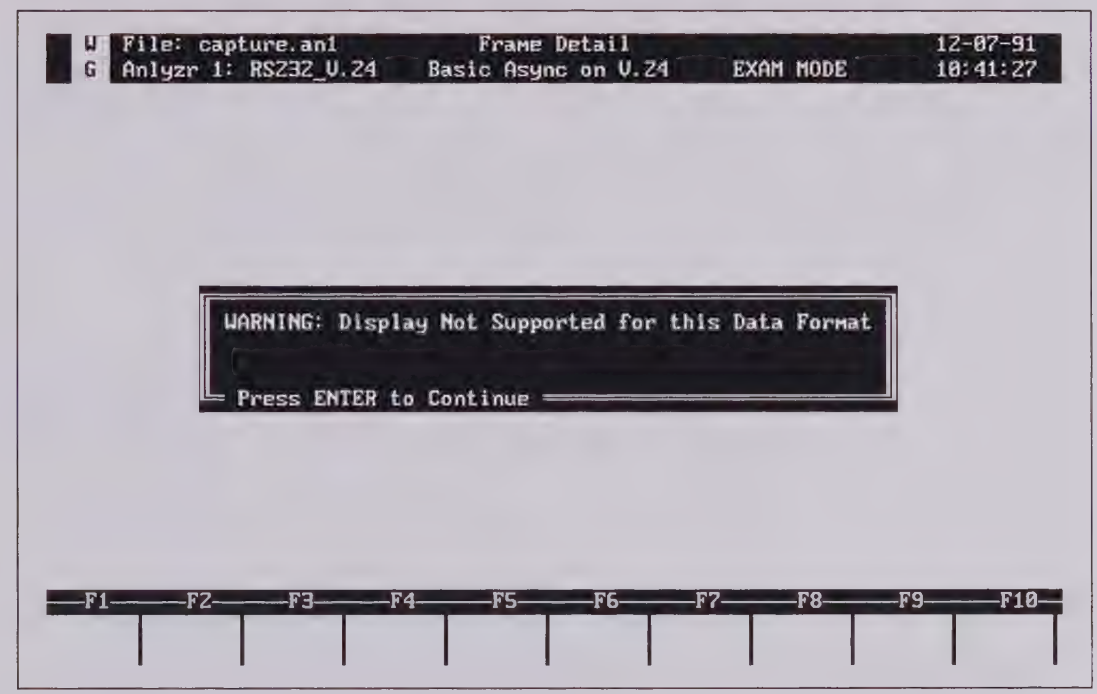

W File: capture.an1 Frame Detail 12-07-91
G Anlyzr 1: RS232_V.24 Basic Async on V.24 EXAM MODE 10:41:27
WARNING: Display Not Supported for this Data Format
Press ENTER to Continue
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10

Figure V24/35-32 Warning: Frame Detail in ASYNC

- **Dropped Bisync and Async Data Framing**
  The high speed interfaces do not support character-oriented protocols (i.e. Bisync) or Asynchronous (Async) data framing. These interfaces support only Bit-Oriented Protocols (BOPs).

In addition to the above-mentioned enhancements, this document describes the installation, external connections, and the software setup for the High Speed V.24 and V.35 Interfaces.

HSV24/V35.2. Installation

The actual Line Interface Modules used for the high speed interfaces are identical to the ones used for the standard interfaces. The differences in their functionality stem from their corresponding feature modules, LIP software and LPP software.

> **Note:**
>
> Before you can use the high speed line interfaces, you must also have a Protocol Analyzer Module and a High Speed WAN Feature Module installed.

HSV24/V35.2.1. Installing the LIM and Installing LIP & LPP Software on the Hard Disk

Installing the LIM:

For the High Speed V.24 Interface, we recommend that you remove the jumpers when operating at data rates exceeding 19.2 kbps.

HSV24/V35.2.2. Loading the LIP & LPP Software

Before using your DA-30 for WAN testing, you should load the LPP software on the OSI protocol stack and then load the LIP software in the card slot containing the LIM.

To load the LPP software:

From the Main Menu, access the protocol stack by moving the cursor to the Active Protocols field within the current Analyzer window and pressing F2 (protocol stack). When the protocol stack appears, move the cursor to the Physical Layer (1), press F1 (view options), and select the appropriate package (HS_V.24 or HS_V.35) from the list.

To load the LIP software:

Move the cursor to the card slot window that corresponds to the slot containing the LIM. Press F1 (view options). Move the cursor to the appropriate package (HS_V.24 or HS_V.35) and press Enter.

HSV24/V35.2.2.1. Auxiliary I/O Pins

> **Note:**
>
> The PAL keywords that monitor and control AUX 1 and AUX 2 will be available in a later release.

HSV24/V35.3. Setting Up The Line Interface

You may select either of the following two setup menus:

- Line Setup
- Control Lead Setup

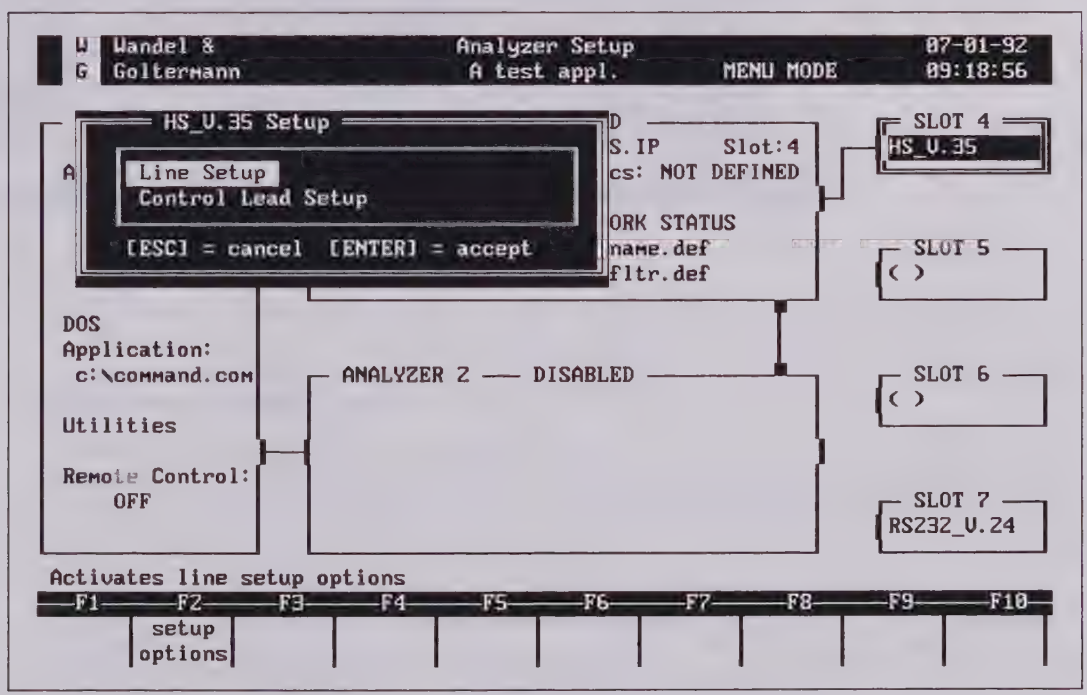


Figure HSV24/V35-1 HS_V.35 Setup Screen

HSV24/V35.3.1. The Line Setup

The cursor should already be on Line Setup. Press F2 (setup options) to see the Line Setup menu shown in Figure HSV24/V35-2.

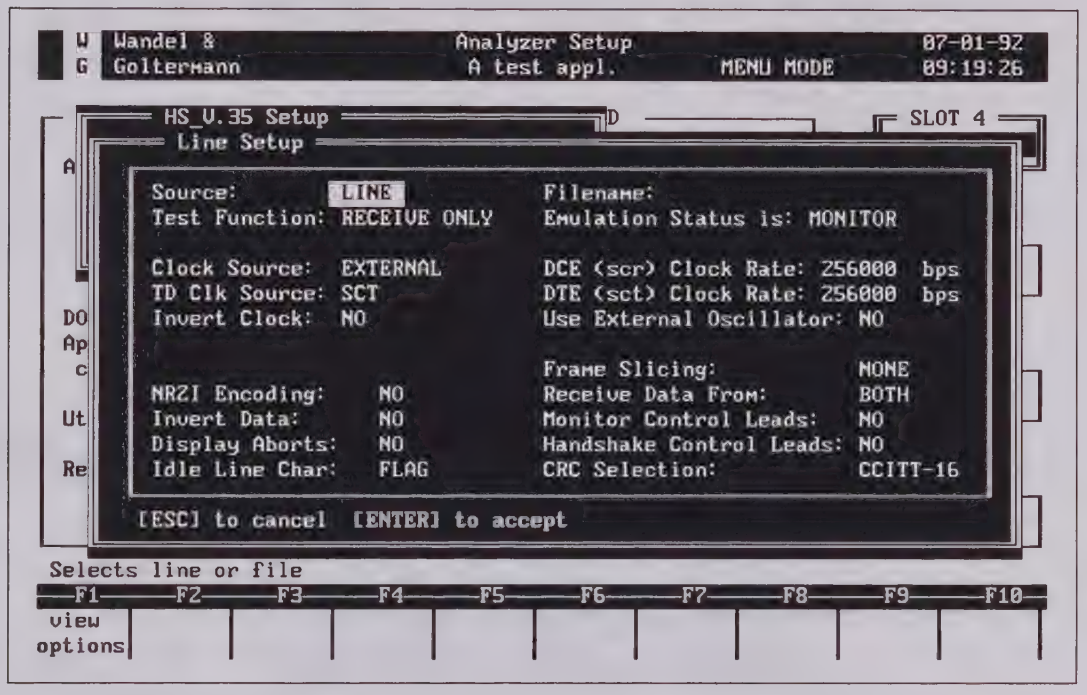


Figure HSV24/V35-2 Line Setup

The Line Setup menu allows you to configure the data line parameters.

HSV24/V35.3.1.1. Source

> **Note:**
>
> A log file cannot be played back onto the network and be decoded by upper layer LPPs without the use of advanced PAL.

HSV24/V35.3.1.2. Test Function

This field allows you to select between three modes of operation:

- RECEIVE ONLY – the DA-30 passively monitors network activity on both sides of the DTE-DCE interface. An uninterrupted signal path is provided between the rear panel DCE and DTE connectors. For example, pin 1 of the DCE connector is internally connected to pin 1 of the DTE connector. Received data is also processed according to the Network Event Program (if defined).

- EMULATE DCE – the DA-30 emulates a DCE device while appropriately driving the CTS, CD, DSR, SCT, and SCR leads. This selection is used when testing DTE equipment (i.e. computer, terminal, etc.). Received data is also processed according to the Network Event Program (if defined).
- EMULATE DTE – the DA-30 emulates a DTE device while appropriately driving the RTS, DTR, and SCTE leads. This selection is used when testing DCE equipment (i.e. modem). Received data is also processed according to the Network Event Program (if defined).

HSV24/V35.3.1.3. Clock Source

This field allows you to select the source of the clocks that the DA-30 provides to the interface. Your selections, here, are valid only in the Emulate DCE and Emulate DTE modes (Table 1).

When **Test Function** is set to:	**Clock Source** determines the source of:
Receive Only	No meaning
Emulate DCE	SCT & SCR clocks
Emulate DTE	SCTE clock

Table 1 Test Function vs Clock Source Control

There are three choices:

- EXTERNAL – This setting is used when the DA-30 acts as a monitor between a DTE and a DCE—with the DA-30 clock being supplied by the DTE, DCE, or some other source. "External" means that the source of the clocks provided by the DA-30 is one of the clock leads on the V.35 interface.

  This setting can also be used when emulating a DTE or DCE. If emulating a DTE, the frequency of SCTE is determined by SCT which is provided by the DCE. If emulating a DCE, the frequency of the transmit and receive clocks (SCT & SCR) are derived from SCTE which is provided by the DTE.

- INTERNAL – This setting is used when the DA-30 is emulating a DTE or DCE. "Internal" simply means that the source of the clocks provided by the DA-30 is either the External Oscillator input or one of the crystal oscillators located on the High Speed WAN Feature Module.

  If emulating a DTE, the DA-30 will generate a clock frequency as close as possible to the rate entered in the DTE Clock Rate field and transmit it on the SCTE lead. The DCE uses SCTE to derive the transmit and receive clocks (SCT & SCR). If emulating a DCE, the DA-30 will generate a clock frequency as close as possible to the rate entered in the DCE Clock Rate field and transmit it on both the SCT and SCR leads.

- SPLIT – This setting is used when you are emulating a DCE in a system where different baud rates are used for receive and transmit data (SCT & SCR clocked at different rates). One baud rate generator is used to generate a clock frequency as close as possible to the rate entered in the DCE Clock Rate field and transmit it on the SCR lead. Another baud rate generator is used to generate a clock frequency as close as possible to the rate entered in the DTE Clock Rate field and transmit it on the SCT lead. When selecting SPLIT as the Clock Source, you must select a DCE Clock Source in the SD Clk Source field.

> **Note:**
>
> The default selection for this field is automatically made based on your Test Function selection. You may override this default selection at any time.

HSV24/V35.3.1.4. TD Clk Source

This field allows you to specify the clock that provides the timing for Transmit Data (TD). The choices are:

- SCT — The SCT clock is used as the timing reference for data transmitted on TD.
- SCTE — The SCTE clock is used as the timing reference for data transmitted on TD.

HSV24/V35.3.1.5. Invert Clock

This field allows you to invert the polarity of the clocks. The choices are:

- NO — The SCR, SCT and SCTE clocks are left unchanged. The DA-30 receives data on the "On-to-Off" transition of the receive clock (SCR) and transmits data on the “Off-to-On” transition of the transmit clocks (SCT & SCTE).
- YES — Inverts the SCR, SCT and SCTE clocks. This means that the DA-30 receives data on the “Off-to-On” transition of SCR (rather than the “On-to-Off” transition) and transmits data on the “On-to-Off” transition of SCT and SCTE.

HSV24/V35.3.1.6. Invert Data

This field enables the interface to meet MIL-188C signalling requirements by inverting the polarity of the data being transmitted on both TD and RD. The choices are:

- NO — The polarity of the data is left unchanged.
- YES — Inverts the polarity of the data.

HSV24/V35.3.1.7. Display Aborts

This field allows you to select whether or not Aborted frames trigger a specific event in the Network Event Program.

- NO
- YES

This field defaults to NO.

HSV24/V35.3.1.8. Idle Line Char

This field allows you to select the character that the receiver interprets as an idle line (no data being transmitted).

- FLAG — Sets the Idle Line Character to 7E (hex).
- MARK — Sets the Idle Line Character to FF (hex).

The default Idle Line Character is FLAG (7E).

HSV24/V35.3.1.9. Filename

When the Source is set to FILE, you enter the name of the logged data file here. To see a list of available filenames to choose from, press F1 (view options). Use the cursor keys to highlight a filename and press Enter to load the file.

HSV24/V35.3.1.10. Emulation Status

This field reports whether the DA-30 is currently monitoring or emulating depending on your Test Function selection (Table 2).

Test Function	Emulation Status
RECEIVE ONLY	MONITOR
EMULATE DCE	EMULATE
EMULATE DTE	EMULATE

Table 2 Emulation Status Field

This is a status field only and cannot be directly modified using the cursor.

HSV24/V35.3.1.11. DCE (scr) Clock Rate

When emulating a DCE, this field is used to set the desired clock rate (in bits/sec) for SCR and/or SCT.

- If Clock Source is set to INTERNAL, this field is used to set the frequency of both the SCR & SCT clocks (Figure HSV24/V35-3).

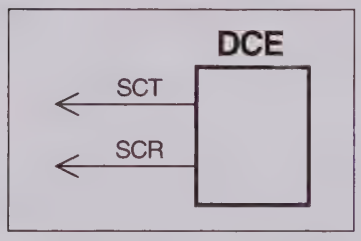


Figure HSV24/V35-3 Setting the Clock Rate When Clock Source Is Set To INTERNAL

- If Clock Source is set to SPLIT, this field is used to set the frequency of the SCR clock only (Figure HSV24/V35-4).

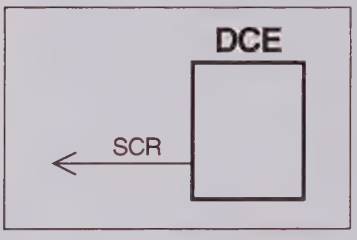


Figure HSV24/V35-4 Setting the Clock Rate When Clock Source Is Set To SPLIT

The DA-30 will generate a frequency as close as possible to the entered value. This field defaults to 256000 bps.

HSV24/V35.3.1.12. DTE (sct) Clock Rate

This field is used to set the desired clock rate (in bits/sec) for SCT or SCTE.

- If Clock Source is set to SPLIT and Test Function is set to EMULATE DCE, this field is used to set the frequency of the SCT clock (Figure HSV24/V35-5).

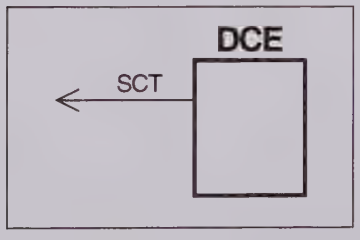


Figure HSV24/V35-5 Setting the Clock Rate When Clock Source Is Set To SPLIT

- If Clock Source is set to EXTERNAL and Test Function is set to EMULATE DTE, this field is used to set the frequency of the SCTE clock (Figure HSV24/V35-6). This field defaults to 256000 bps.

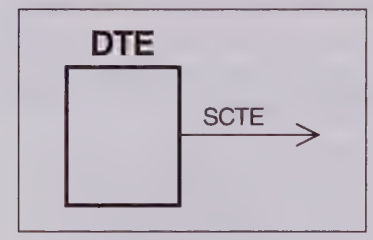


Figure HSV24/V35-6 Setting the Clock Rate When Clock Source Is Set To EXTERNAL

HSV24/V35.3.1.13. Use External Oscillator

This field determines how the transmit and receive clocks are generated—internally or externally. The choices are:

- YES – The transmit and receive clocks are derived from a clock signal at the External Oscillator input (BNC) on the rear panel of the High Speed WAN Feature Module. The crystal oscillators on the High Speed WAN Feature Module are disabled. The frequency at the External Oscillator input will be calculated upon entering the Run Mode.
- NO – The transmit and receive clocks are derived from the crystal oscillators on the High Speed WAN Feature Module. The External Oscillator input is disabled.

HSV24/V35.3.1.14. Receive Data From

The received data that is processed by the analyzer can come from either or both sides of the interface. This field allows you to make that selection. The choices are:

- BOTH – Signals from both the DTE and the DCE sides of the interface are passed to the analyzer for processing.
- DTE – Only signals from the DTE side of the interface are passed up to the analyzer for processing.
- DCE – Only signals from the DCE side of the interface are passed up to the analyzer for processing.

This field defaults to BOTH.

HSV24/V35.3.1.15. Monitor Control Leads

This field allows you to monitor the activity of the data and control leads (TD, RD, RTS, CTS, DCD, DSR, and DTR). The choices are:

NO – The data and control leads are not monitored.

YES – The data and control leads are monitored. Their activity is displayed in the Control Lead Activity section of the Network Status screen. This selection allows you to program the interface using the control lead condition keywords. These keywords are described in the "High Speed V.35 PAL Reference" section of the *DA-30/31 Line Interface Programming* binder. This binder is part of the *DA-30/31 Programming Documentation Set* which is sold separately.

> **Note:**
>
> Selections in this field are valid only when Source is set to LINE.

This field defaults to NO.

HSV24/V35.3.1.16. Handshake Control Leads

> **Note:**
>
> Enabling control lead handshaking may degrade overall performance by an unspecified amount.

HSV24/V35.3.1.17. CRC Selection

This field allows you to select the frame check sequence (CRC) polynomial that is used. The choices are:

- CCITT-16 – Selects the following 16-bit CCITT polynomial:

  $(x^{16} + x^{15} + x^{2} + 1)$

- CRC-32 – Selects the following 32-bit Ethernet polynomial:

  $(x^{32} + x^{26} + x^{23} + x^{22} + x^{16} + x^{12} + x^{11} + x^{10} + x^{8} + x^{7} + x^{5} + x^{4} + x^{2} + x^{1})$

- NONE – All CRC checking is disabled. No CRC is generated for transmitted frames, and all received frames are assumed to have good CRCs.

HSV24/V35.3.2. Control Lead Setup

Move the cursor to Control Lead Setup and press F2 (lead options) to see the Control Lead Setup menu shown in Figure HSV24/V35-7.

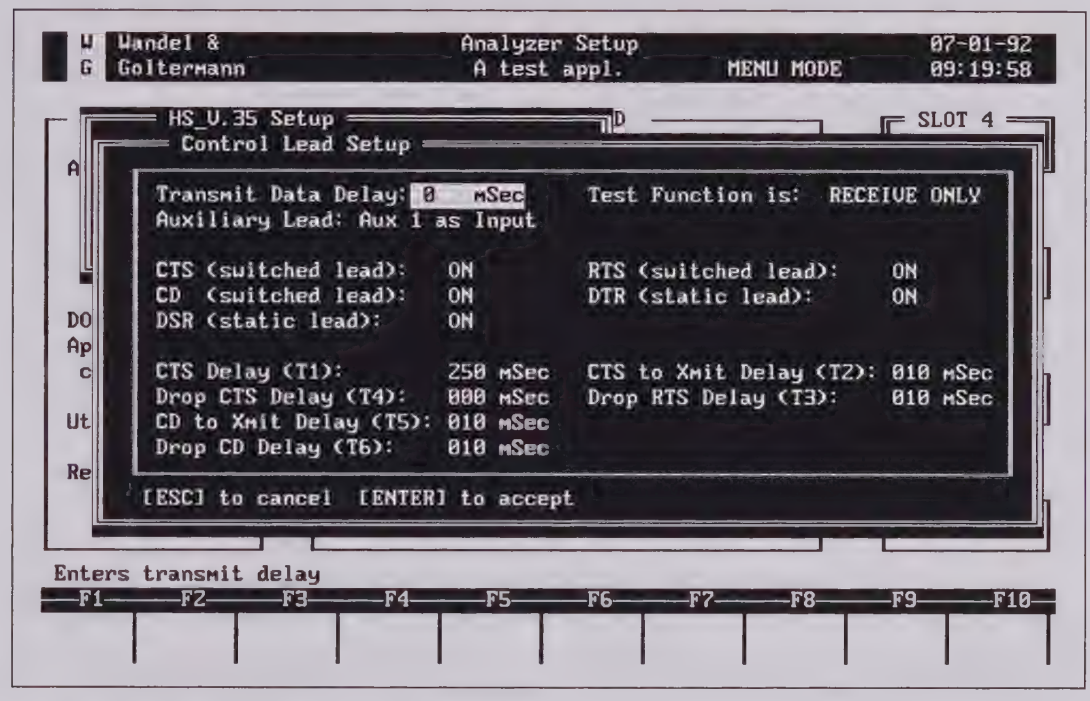

Wandel &
Goltermann
Analyzer Setup
A test appl.
MENU MODE
07-01-92
09:19:58
HS_V.35 Setup
Control Lead Setup
SLOT 4
Transmit Data Delay: 0 mSec
Test Function is: RECEIVE ONLY
Auxiliary Lead: Aux 1 as Input
CTS (switched lead): ON
RTS (switched lead): ON
CD (switched lead): ON
DTR (static lead): ON
DSR (static lead): ON
CTS Delay (T1): 250 mSec
CTS to Xmit Delay (T2): 010 mSec
Drop CTS Delay (T4): 000 mSec
Drop RTS Delay (T3): 010 mSec
CD to Xmit Delay (T5): 010 mSec
Drop CD Delay (T6): 010 mSec
[ESC] to cancel [ENTER] to accept
Enters transmit delay
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10

Figure HSV24/V35-7 Control Lead Setup

This menu allows you to setup the initial state of the control leads as well as set the timing relationships between them. Your settings here are used only when the Test Function is set to EMULATE DCE or EMULATE DTE.

HSV24/V35.3.2.1. Transmit Data Delay

This field allows you to set the delay (in milliseconds) between the time the DA-30 becomes ready to transmit (generate or playback) and the time it indicates its readiness to transmit (by raising the appropriate control lead). See Figure HSV24/V35-8.

- When emulating a DTE, the RTS lead is driven HIGH after the specified delay.
- When emulating a DCE, the CD lead is driven HIGH after the specified delay.

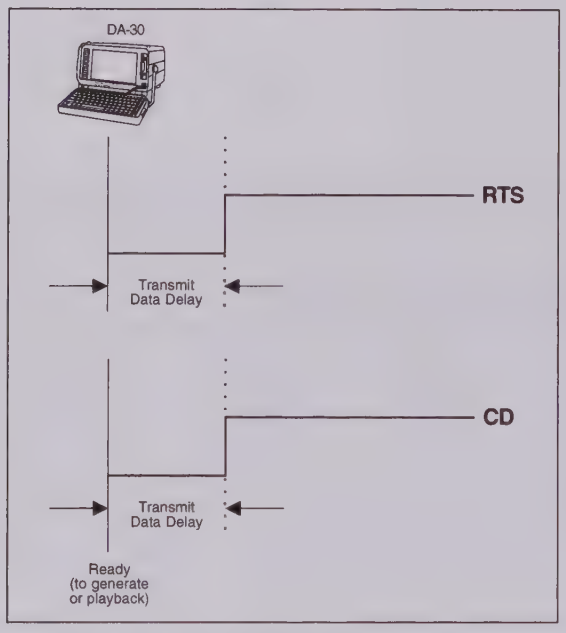


Figure HSV24/V35-8 Transmit Delay

The delay can range from 0 to 999 milliseconds and defaults to 0 mSec.

HSV24/V35.3.2.2. Auxiliary Lead

This field allows you to drive/monitor one of the auxiliary leads on the rear panel of the LIM. You may select auxiliary lead 1 (AUX 1) or 2 (AUX 2) and its function (input or output). The selected auxiliary lead status is displayed by the front-panel LED labelled U/A.

The choices are:

- Aux 1 as Input – The AUX 1 lead is configured as an input.
- Aux 1 as Output Off – The AUX 1 lead is configured as an output and driven to the Off state.
- Aux 1 as Output On – The AUX 1 lead is configured as an output and driven to the On state.
- Aux 2 as Input – The AUX 2 lead is configured as an input.
- Aux 2 as Output Off – The AUX 2 lead is configured as an output and driven to the Off state.
- Aux 2 as Output On – The AUX 2 lead is configured as an output and driven to the On state.

Note:

The "Aux 1 as Input" and "Aux2 as Input" selections are scheduled for future implementation.

HSV24/V35.3.2.3. Test Function is

This is a status field that reports the Test Function setting (from the Line Setup menu) for your convenience.

HSV24/V35.3.2.4. CTS (switched lead)

This field allows you to select how the CTS (Clear To Send) control lead behaves during Run Mode. The CTS lead can be controlled only when emulating a DCE.

- OFF – The lead is driven LOW. If emulating a DTE, the DA-30 will transmit (on TD)—ignoring the CTS OFF condition.
- ON – The lead is driven HIGH. If emulating a DTE, the DA-30 will transmit (on TD) without waiting for CTS ON.
- SWITCH – The lead is turned ON and OFF under the control of the LIP. The initial state is OFF. If emulating a DTE, the DA-30 will wait for CTS ON before transmitting (on TD).

  You may specify a delay that the DA-30 waits before turning CTS ON after detecting RTS ON. See the CTS Delay (T1) field.

  You may also specify a delay that the DA-30 waits before turning CTS OFF after detecting RTS OFF. See the Drop CTS Delay (T4) field.

This field defaults to ON.

HSV24/V35.3.2.5. CD (switched lead)

This field defaults to ON.

HSV24/V35.3.2.6. RTS (switched lead)

This field defaults to ON.

HSV24/V35.3.2.7. DTR (static lead)

This field allows you to select how the DTR (Data Terminal Ready) control lead behaves during Run Mode. The DTR lead can be controlled only when emulating a DTE.

- OFF – The lead is driven continuously LOW.
- ON – The lead is driven continuously HIGH.

This field defaults to ON.

Note About Switched Leads:

In general, when a switched lead is set to ON or OFF, the DA-30 will do so without respect to V.24 or V.35 handshaking rules. However, when a switched lead is set to SWITCH and Handshake Control Leads is set to YES, normal handshaking rules will be observed. Thus, for proper operation, it is important that you make sure the device under test provides those handshaking signals that the DA-30 expects from the other side of the interface. The expected handshaking signals will, of course, depend on the emulation (DTE or DCE).

Table 3 summarizes the behavior of the control leads depending on their setting and the Test Function of the DA-30.

LEAD	SETTING	MEANING
Test Function = Emulate DTE		
RTS	OFF	Turns RTS OFF upon entering RUN Mode.
	ON	Turns RTS ON upon entering RUN Mode.
	SWITCH	Turns RTS ON before each transmission (TD). Turns RTS OFF after each transmission.
CTS	OFF	Turns CTS OFF upon entering RUN Mode. Transmits without respect to CTS OFF.
	ON	Turns CTS ON upon entering RUN Mode. Transmits without respect to CTS ON.
	SWITCH	Waits for CTS ON before each transmission.
CD	OFF	Turns CD OFF upon entering RUN Mode. Raises RTS for new transmission without respect to CTS OFF.
	ON	Turns CD ON upon entering RUN Mode. Raises RTS for new transmission without respect to CTS OFF.
	SWITCH	Waits for CTS OFF before raising RTS for new transmission.
Test Function = Emulate DCE		
RTS	OFF	Turns RTS OFF upon entering RUN Mode. Raises CD to transmit (RD) without waiting for CTS OFF.
	ON	Turns RTS ON upon entering RUN Mode. Raises CD to transmit (RD) without waiting for CTS OFF.
	SWITCH	Waits for CTS OFF before raising CD to transmit (if CTS & CD are switched).
CTS	OFF	Turns CTS OFF upon entering RUN Mode.
	ON	Turns CTS ON upon entering RUN Mode.
	SWITCH	Turns CTS ON after RTS ON.
CD	OFF	Turns CD OFF upon entering RUN Mode.
	ON	Turns CD ON upon entering RUN Mode.
	SWITCH	Turns CD ON before each transmission. Turns CD OFF after each transmission.

Table 3 Control Lead Selection Summary

Table 4 shows some standard switched-lead settings for full-duplex and half-duplex systems.

CONFIGURATION	RTS	CTS	CD	EMULATION
Full-Duplex	ON	ON	ON	DTE
Half-Duplex	SWITCH	SWITCH	SWITCH	
Multi-point/Primary	ON	ON	SWITCH	
Multi-point/Secondary	SWITCH	SWITCH	ON	
Full-Duplex	ON	ON	ON	DCE
Half-Duplex	SWITCH	SWITCH	SWITCH	
Multi-point/Primary	ON	ON	SWITCH	
Multi-point/Secondary	SWITCH	SWITCH	ON	

Table 4 Standard Switched-Lead Settings

HSV24/V35.4. TESTPREP Consistency Check

After you have the completed the interface setup (Line Setup and Control Lead Setup) and returned to the Main menu, you can run your current application by going to the Run Mode (press the Alt-Run keys). Before going from the Menu Mode to the Run Mode, the DA-30 runs a program called TESTPREP that checks to see if all your setup entries are consistent before compiling and running your application. If you have inadvertently created an inconsistent setup, TESTPREP flags the problem. A warning message will appear offering you the option of returning to Menu Mode to correct the inconsistent settings or allowing the DA-30 to change them for you. See Figure HSV24/V35-9. If you choose the latter, the change takes effect in Run Mode only; that is, the menu selection is not physically altered. Running the application again without making the necessary correction(s) in the setup menus produces the same results. Therefore, upon seeing the warning message, you may wish to return to Menu Mode, correct the inconsistency, and save the application before running again.

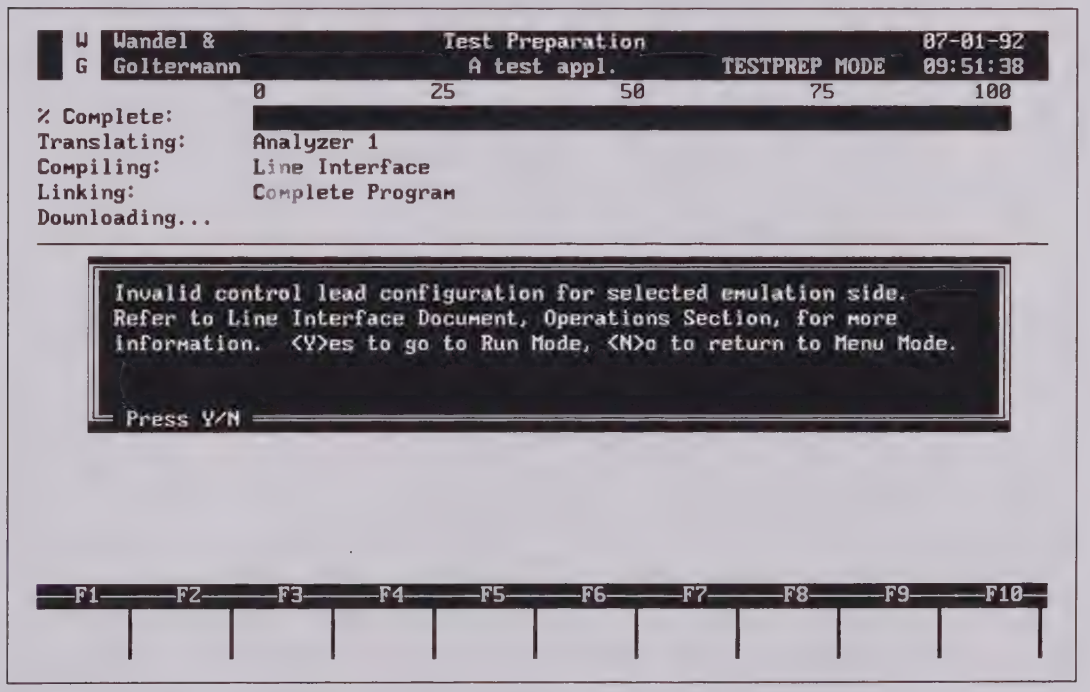


Figure HSV24/V35-9 TESTPREP Warning

Note:

Recompilation does not always occur upon entering the Run Mode. Your application will be recompiled whenever either of the following Line Setup settings are modified:

- Source
- Handshake Control Leads

HSV24/V35.5. Viewing Results in Run Mode

> **Note:**
>
> For maximum performance and speed, only load lower layer protocols in the protocol stack. However, when you want to view higher layer protocols, note that there may be a slight degradation in performance.

HSV24/V35.5.1. Network Status Screen, Run Mode

The Run Mode Network Status screen for the high speed interfaces have been revised. They contain all the information on the standard screen—with some additional information (Figure HSV24/V35-10). However, less emphasis is placed on the control leads.

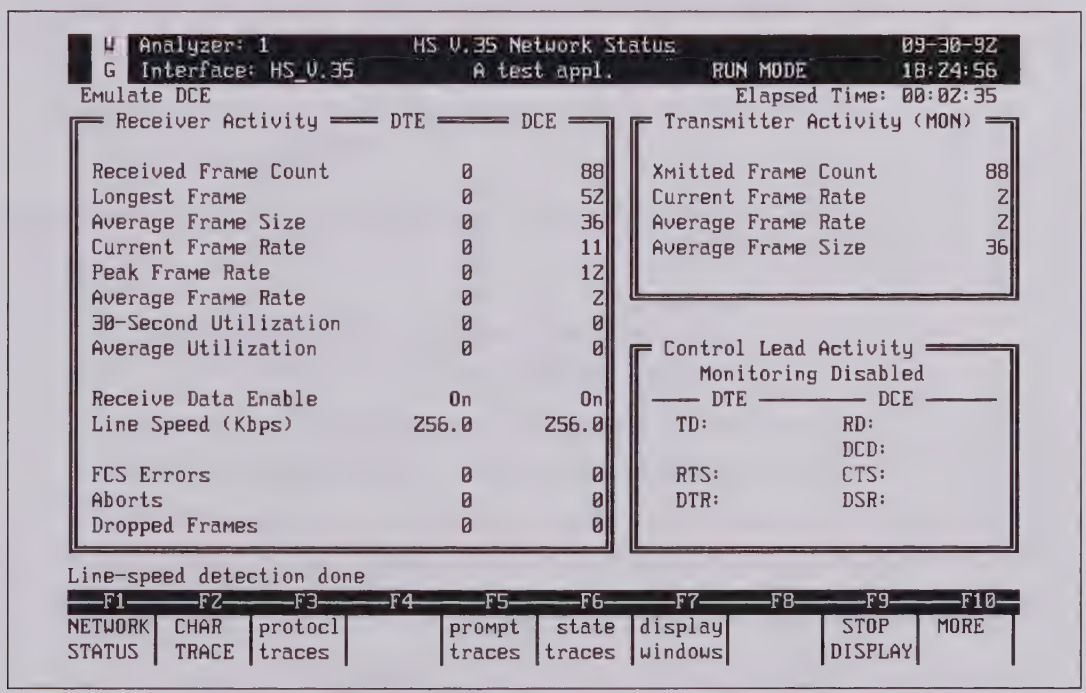


Figure HSV24/V35-10 RUN Mode Network Status Screen

The first line of this screen displays the current Test Function setting as well as an Elapsed Time counter that reports the time that elapsed since the current application started running.

HSV24/V35.5.1.1. Receiver Activity

This section of the Network Status screen displays receiver information.

> **Note:**
>
> The maximum receive frame size is 3928 bytes.

- Current Frame Rate—the frame rate (Frames per second) detected at the receiver.
- Peak Frame Rate—the highest frame rate (Frames per second) detected at the receiver since receiving began.
- 30-Second Utilization—the average utilization (%) for the past 30-second interval. This field is a "sliding-window" that is updated every second. During the first 30 seconds after entering Run Mode, this value is the average utilization for that period. Accuracy is 100 ppm.
- Average Utilization—the average utilization (%) since receiving began.

> **Note:**
>
> The 30-Second Utilization and Average Utilization fields are supported when Test Function is set to:
>
> - Emulate DCE
> - Emulate DTE or Receive Only (if a clock is detected on SCT & SCR upon entering Run Mode).
>
> Otherwise, these fields will display "Unavail".

- Receive Data Enable—This field tells which side of the interface (DTE and/or DCE) is enabled for receiving. This field gets its information from the Receive Data From setting on the Line Setup menu (Table 5).

Receive Data From Setting	**Receive Data Enable** Status	
	DTE	**DCE**
BOTH	On	On
DCE	Off	On
DTE	On	Off

Table 5 Receive Data Enable Status Indicators

- Line Speed (Kbps)—On entering the Run Mode, the line speed is determined if possible. Once determined, this value is displayed here. The line speed value is also used to calculate the Average and 30-Second Utilization values.

If, for some reason, it is not possible to determine the line speed (i.e. DA-30 not connected to the line in the RECEIVE ONLY or EMULATE DTE mode), the Line Speed is displayed as 0 and the utilization fields are displayed as unavailable ("Unavail").

- FCS Errors—this counter is incremented each time a Frame Check Sequence (CRC) error occurs.
- Aborts—this counter is incremented each time an Abort occurs. An Abort is defined to be the reception of seven (7) consecutive one (1) bits.
- Dropped Frames—This field provides a count of the number of frames that the Line Interface was able to receive, but the DA-30 itself could not accept for processing. The frames are "dropped," or thrown away, after being received.

> **Note:**
>
> These frames are not included in any other statistic.

The **total** number of frames received at the line interface is equal to the sum of this value and the Received Frame Count value (described earlier).

HSV24/V35.5.1.2. Transmitter Activity

This section of the Network Status screen displays transmitter information. Depending on the Test Function, the area inside the parentheses, ( ), will contain one of the following designations:

MON. When RECEIVER ONLY is the selected Test Function.

DTE. When EMULATE DTE is the selected Test Function.

DCE. When EMULATE DCE is the selected Test Function.

Whether emulating a DTE or DCE, this section reports the following information:

- Xmitted Frame Count—the current number of frames that have been transmitted.
- Current Frame Rate—the current rate at which the DA-30 is transmitting frames.
- Average Frame Rate—the current average rate (Frames per second) at which frames are being transmitted.
- Average Frame Size—the current average size (in bytes) of the transmitted frames since transmission began.

HSV24/V35.5.1.3. Control Lead Activity

This section of the Network Status screen displays control and data lead information when receiving data from the line. The control and data lead fields are grouped by line-side emulation. Each control lead field displays an approximate representation of the corresponding control lead status. The state of the control leads is indicated as shown in Table 6.

Status	Meaning
On / nc	The control lead carries a positive voltage or is not connected (or connected to a "dead" line).
Off	The control lead carries a negative voltage.

Table 6 Control Lead Status Indicators

The data leads (TD and RD) are monitored via software. The LIM has no direct method of determining the data lead status. The state of the data leads is indicated as shown in Table 7.

Status	Meaning
Data	A frame was received during the data lead sample interval.
Idle	A frame was not received during the data lead sample interval.

Table 7 Data Lead Status Indicators

As with the standard interfaces, the high speed interface control lead activity is NOT correlated with the received frames. This means that the control lead activity is a frame-independent "snap shot" of the control leads at a given instant in time.

Note:

A majority of control lead events will be missed—especially at high bit rates.

This section of the screen is enabled only when Monitor Control Leads is set to YES on the Line Setup menu. When Monitor Control Leads is set to NO, the control lead fields are left blank, and "Monitoring Disabled" is displayed. The control lead fields are also left blank whenever playing back data from a logged file (i.e Source is set to FILE).

The last line of the Network Status screen reports the status of the line speed calculation (at the receiver). When the calculation is being performed, the following message is reported:

```
"Determining Line Speed"
```

After the calculation has been performed, the following message is reported:

```
"Line-speed detection done"
```

HSV24/V35.5.2. Character Trace Screen, Run Mode

The Run Mode Character Trace screen looks just like the one described for the standard interfaces.

HSV24/V35.5.3. Network Status Screen, Examine Mode

To access the Network Status screen, press F1 (NETWORK STATUS) from the Examine Mode Top Rack. This screen is identical to the Run Mode Network Status screen.

HSV24/V35.5.4. Character Trace Screen, Examine Mode

The Character Trace screen for the Examine Mode looks just like the one described in Run Mode.

HSV24/V35.6. High Speed V.35 Clock Configurations

In the high speed packages, we have made every attempt to provide the flexibility of clock routing that is required for a protocol analyzer—while keeping the setup as straightforward as possible. This section explains the different possible clock routing configurations and how to setup the high speed interfaces for each configuration.

There are three fields that are used to route the clocks: Test Function, Clock Source and TD Clk Source. For each of the following configurations, a table is presented that shows you how to setup these clock routing fields for the corresponding configuration.

HSV24/V35.6.1. Configuration 1

This is the default configuration (Figure HSV24/V35-11) for the DA-30. In this configuration, the SCT and SCR clocks are generated by the DCE and provide the timing for TD and RD, respectively.

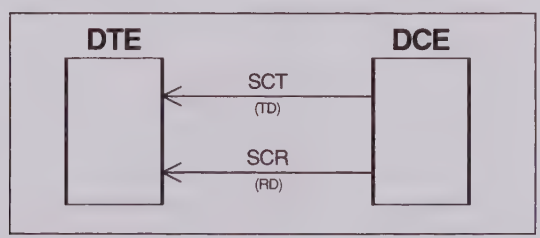


Figure HSV24/V35-11 Clock Configuration 1

The clock routing setups for Configuration 1 are shown in Table 8.

Test Function	Clock Source	TD Clk Source
RECEIVE ONLY	EXTERNAL	SCT
EMULATE DCE	INTERNAL	SCT
EMULATE DTE	EXTERNAL	SCT

Table 8 Clock Setups for Clock Configuration 1

HSV24/V35.6.2. Configuration 2

In this configuration (Figure HSV35-12), the DCE generates the SCT and SCR clocks. SCR provides the timing for RD. The DTE uses SCT to clock data out on TD. The DTE also regenerates the SCT on the SCTE circuit and synchronizes it with the data on TD. The DCE then uses SCTE to receive TD.

This implementation is often used at clock rates above 300 kHz to compensate for skew between SCT and TD caused by propagation delay.

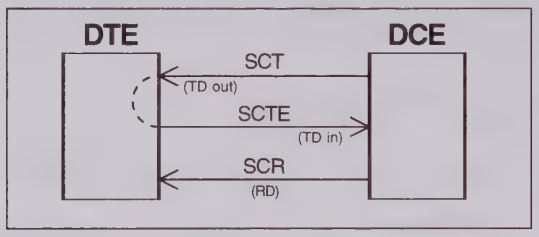


Figure HSV24/V35-12 Clock Configuration 2

The clock routing setups for Configuration 2 are shown in Table 9.

Test Function	Clock Source	TD Clk Source
RECEIVE ONLY	EXTERNAL	SCTE
EMULATE DCE	INTERNAL	SCTE
EMULATE DTE	EXTERNAL	SCTE

Table 9 Clock Setups for Clock Configuration 2

HSV24/V35.6.3. Configuration 3

In this configuration (Figure HSV35-13), the DTE generates a clock on SCTE. The DCE takes SCTE and loops it back on SCT and SCR. SCT and SCR provide the timing for TD and RD, respectively.

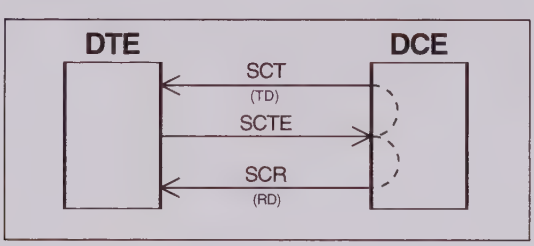


Figure HSV24/V35-13 Clock Configuration 3

The clock routing setups for Configuration 3 are shown in Table 10.

Test Function	Clock Source	TD Clk Source
RECEIVE ONLY	EXTERNAL	SCT
EMULATE DCE	EXTERNAL	SCT
EMULATE DTE	INTERNAL	SCT

Table 10 Clock Setups for Clock Configuration 3

HSV24/V35.6.4. Configuration 4

This configuration (Figure HSV35-14) is the same as Configuration 3 except that the timing for TD is provided by SCTE.

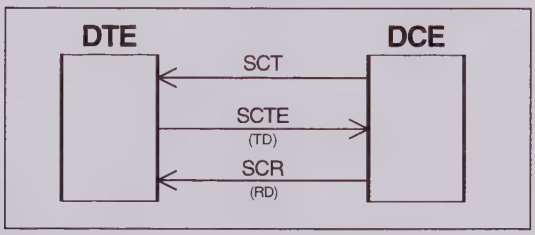


Figure HSV24/V35-14 Clock Configuration 4

The clock routing setups for Configuration 4 are shown in Table 11.

Test Function	Clock Source	TD Clk Source
RECEIVE ONLY	EXTERNAL	SCTE
EMULATE DCE	EXTERNAL	SCTE
EMULATE DTE	INTERNAL	SCTE

Table 11 Clock Setups for Clock Configuration 4

HSV24/V35.6.5. Configuration 5

In this configuration (Figure HSV35-15), the DTE generates SCTE which provides the timing for TD. The DCE generates SCR which provides the timing for RD.

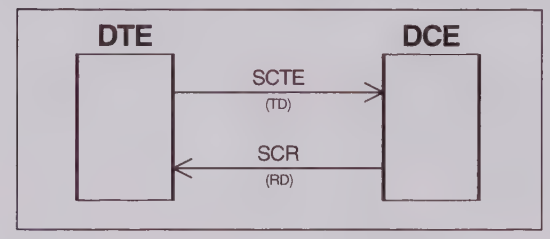


Figure HSV24/V35-15 Clock Configuration 5

The clock routing setups for Configuration 5 are shown in Table 12.

Test Function	Clock Source	TD Clk Source
RECEIVE ONLY	EXTERNAL	SCTE
EMULATE DCE	INTERNAL	SCTE
EMULATE DTE	INTERNAL	SCTE

Table 12 Clock Setups for Clock Configuration 5

Fifth Edition October 1993 Release 3.4 and after

V.24/V.35

RS-232C / V.24 and V.35 PAL References

V24/35.1. Introduction

The RS-232C/V.24 and V.35 PAL keywords contained in their respective Layer Protocol Package (LPP) allow you to write protocol-specific Network Event Programs and use them in RS-232C/V.24 and V.35 applications. These keywords can be used by themselves or in combination with core keywords within an event. The Network Event Program simplifies the programming process with the softkey-guided mode.

PAL keywords are available in the Network Event Program Editor only when the RS232_V.24 or V.35 LPP is loaded at Layer 1 of the DA-30 protocol stack. Using PAL with either the RS-232C/V.24 or V.35 Interface is, essentially, a way to monitor and manipulate the interface control leads--overriding the settings on the Control Lead Setup screen. Table 1 lists the control leads and their mnemonics.

Control Leads	
Request To Send	RTS
Clear To Send	CTS
Carrier Detect	CD
Data Terminal Ready	DTR
Data Set Ready	DSR
Ring Indicator	RI
Auxiliary #1	AUX 1
Auxiliary #2	AUX 2

Table 1 Control Leads and their Mnemonics

The PAL keywords are divided into the following two groups:

- protocol condition keywords
- protocol action keywords

V24/35.2. Protocol Condition Keywords

The protocol condition keywords allow you to evaluate frames received from a DTE or DCE as well as monitor the control leads. The protocol condition keywords available for evaluating received frames are:

- RCVD
- BAD.FCS
- ABORT
- PARITY
- FRAME ERROR

The protocol condition keywords available for monitoring the control leads are:

- RTS
- CTS
- CD
- DTR
- DSR
- RI
- UA

Note:

When using the control lead condition keywords, be sure to set the Monitor Control Leads field (of the Line Setup menu) to YES. Otherwise, the status of the control leads will be ignored.

The discussion of each keyword includes a syntactical model, a description and an example of its use.

RCVD

Syntax:

DCE RCVD
DTE RCVD

Description:

This condition is true when a valid frame is received. It can be used for either the DTE or DCE side of the interface.

Type:

External

Example:

```
COND DCE RCVD
ACTN PROMPT "Frame received on DCE side"
```

Remarks:

None

BAD.FCS

Syntax:

DCE BAD.FCS
DTE BAD.FCS

Description:

This condition is true when a frame with a bad frame check sequence is received. It can be used for either the DTE or DCE side of the interface.

Type:

External

Example:

```
COND DTE BAD.FCS
ACTN PROMPT "The frame has bad FCS"
```

Remarks:

None

ABORT

Syntax:

DCE ABORT
DTE ABORT

Description:

This condition is true when either an aborted frame or an aborted frame check sequence--following the previous flag--is received. It can be used for either the DTE or DCE side of the interface.

Type:

External

Example:

```
COND DTE ABORT
     TIMEOUT count.down OR
ACTN PROMPT "Aborted frame or timeout"
```

Remarks:

None

PARITY

Syntax:

DCE PARITY
DTE PARITY

Description:

This condition is true when there is a parity error in the received frame. It can be used for either the DTE or DCE side of the interface.

Type:

External

Example:

```
COND DTE PARITY
ACTN PROMPT " DTE received"
```

Remarks:

Parity is evaluated according to the Parity setting on the Line Setup menu.

FRAME ERROR

Syntax:

DCE FRAMING.ERROR
DTE FRAMING.ERROR

Description:

This condition is true when a framing error is detected. It can be used for either the DTE or DCE side of the interface.

Type:

External

Example:

```
COND DTE FRAMING.ERROR
ACTN PROMPT "FRAME ERROR. Evaluate now!"
```

Remarks:

None

RTS

Syntax: RTS ON
RTS OFF

Description: This condition is true when the Request To Send (RTS) pin makes a transition to the specified state. The valid states are ON and OFF.

Type: External

Example:
```
COND RTS ON
ACTN PROMPT "RTS pin is on"
```

Remarks: None.

CTS

Syntax: CTS ON
CTS OFF

Description: This condition is to true when the Clear To Send (CTS) pin makes a transition to the specified state. The valid states are ON and OFF.

Type: External

Example:
```
COND CTS OFF
ACTN PROMPT "CTS is now off"
```

Remarks: None.

CD

Syntax:

CD ON
CD OFF

Description: This condition is true when the Carrier Detect (CD) pin makes a transition to the specified state. The valid states are ON and OFF.

Type: External

Example:

```
COND CD ON
ACTN PROMPT "CD pin on"
```

Remarks: None

DTR

Syntax:

DTR ON
DTR OFF

Description:

This condition is true when the Data Terminal Ready (DTR) pin makes a transition to the specified state. The valid states are ON and OFF.

Type:

External

Example:

```
COND DTR OFF
ACTN PROMPT "DTR switched off"
```

Remarks:

None

DSR

Syntax:

DSR ON
DSR OFF

Description:

This condition is true when the Data Set Ready (DSR) pin makes a transition to the specified state. The valid states are ON and OFF.

Type:

External

Example:

```
COND DSR OFF
     TIMEOUT count.down OR
ACTN PROMPT "DSR pin low or timeout occurred"
```

Remarks:

None

RI

Syntax: RI ON
RI OFF

Description: This condition is true when the Ring Indicator (RI) pin makes a transition to the specified state. The valid states are ON and OFF.

Type: External

Example:
```
COND RI ON
ACTN RESET count.frame
```

Remarks: None

UA

Syntax: UA ON
UA OFF

Description: This condition is true when the AUX 1 auxiliary pin, on the rear panel of the LIM, makes a transition to the specified state. The valid states are ON and OFF.

Type: External

Example:
```
COND UA ON
ACTN NEXT.STATE second
```

Remarks: Currently, the DA-30 can only monitor the state of the AUX 1 pin. AUX 2 pin monitoring capability will be available in a later release.

V24/35.3. Protocol Action Keywords

The protocol action keywords allow you to manipulate (drive) the interface control leads--overriding the settings on the Control Lead Setup screen. The protocol action keywords available for manipulating control leads are:

- RTS
- CTS
- CD
- DTR
- DSR
- RI
- UA

The discussion of each keyword includes a syntactical model, a description and an example of its use.

> **Note:**
>
> Using PAL to override the Control Lead Setup Screen is only valid when Test Mode on the Line Setup is set to Emulate. If emulating a DTE, RTS, DTR, and UA are valid keywords. If emulating a DCE, the valid keywords are CTS, CD, DSR, RI and UA.

Since the protocol action keywords allow you to freely drive control leads ON or OFF, it is possible to inadvertently violate the RS-232C/V.24 and V.35 rules of control lead handshaking that are required for data transmission. At the same time, this freedom allows you to emulate/test for atypical or erroneous control lead handshaking.

RTS

Syntax: RTS ON
RTS OFF

Description: This action drives the Request To Send (RTS) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:
```
COND DSR ON
ACTN RTS ON
```

Remarks: None

CTS

Syntax:

CTS ON
CTS OFF

Description:

This action drives the Clear To Send (CTS) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:

```
COND DSR OFF
ACTN CTS ON
```

Remarks:

None

CD

Syntax:

CD ON
CD OFF

Description:

This action drives the Carrier Detect (CD) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:

```
COND DSR ON
ACTN CD ON
```

Remarks:

None

DTR

Syntax:

DTR ON
DTR OFF

Description:

This action drives the Data Terminal Ready (DTR) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:

```
COND DSR ON
ACTN DTR OFF
```

Remarks:

None

DSR

Syntax:

DSR ON
DSR OFF

Description:

This action drives the Data Set Ready (DSR) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:

```
COND RI OFF
     TIMED count.down OR
ACTN DSR ON
```

Remarks:

None

RI

Syntax: RI ON
RI OFF

Description: This action drives the Ring Indicator (RI) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:
```
COND DSR ON
ACTN RI OFF
```

Remarks: None

UA

Syntax: UA ON
UA OFF

Description: This action drives the AUX 1auxiliary pin, on the rear panel of the LIM, to the specified state. The valid states are ON and OFF.

Example:
```
COND DSR ON
ACTN UA ON
```

Remarks: Currently, the DA-30 can only drive the state of the AUX 1 pin. AUX 2 pin driving capability will be available in a later release.

HSV.24/V.35

High Speed RS-232C/V.24 and V.35 PAL References

(Addendum to the RS-232C/V.24 and V.35 PAL References Document)

HSV24/V35.1. Introduction

The programming features of the High Speed V.24 and V.35 Interfaces are practically the same as those of the standard V.24 and V.35 Interfaces. However, the ability to saturate (flood) the network with user-defined frames has been added. Two new PAL keywords associated with the "flood network" functionality have been added to the Layer Protocol Package (LPP):

- FLOOD.NETWORK
- STOP.FLOOD.NETWORK.

The HS_V.24 or HS_V.35 PAL keywords contained in the Layer Protocol Package (LPP) allow you to write protocol-specific Network Event Programs and use them in V.24 or V.35 applications. These keywords can be used by themselves or in combination with core keywords within an event. The Network Event Program simplifies the programming process with the softkey-guided mode.

High Speed V.24 or V.35 PAL keywords are available in the Network Event Program Editor only when the HS_V.24 or HS_V.35 LPP is loaded at Layer 1 of the DA-30 protocol stack. Using PAL with the High Speed V.24 or V.35 Interface is, essentially, a way to monitor and manipulate the interface control leads—overriding the settings on the Control Lead Setup screen. Table 1 lists the control leads and their mnemonics.

Control Leads	
Request To Send	RTS
Clear To Send	CTS
Carrier Detect	CD
Data Terminal Ready	DTR
Data Set Ready	DSR
Ring Indicator	RI
Auxiliary #1	AUX 1
Auxiliary #2	AUX 2

Table 1 Control Leads and their Mnemonics

The PAL keywords are divided into the following two groups:

- protocol condition keywords
- protocol action keywords

> **Note:**
>
> The PAL keywords that monitor and control the Auxiliary #1 (AUX 1) and Auxiliary #2 (AUX 2) control leads will be available in a later release.

HSV24/V35.2. Protocol Condition Keywords

The protocol condition keywords allow you to evaluate frames received from a DTE or DCE as well as monitor the control leads. The protocol condition keywords available for evaluating received frames are:

- RCVD
- BAD.FCS
- ABORT
- FRAME ERROR

The protocol condition keywords available for monitoring the control leads are:

- RTS
- CTS
- CD
- DTR
- DSR
- RI

> **Note:**
>
> When using the control lead condition keywords, be sure to set the Monitor Control Leads field (of the Line Setup menu) to YES. Otherwise, the status of the control leads will be ignored.

The discussion of each keyword includes a syntactical model, a description and an example of its use.

RCVD

Syntax:

DCE RCVD
DTE RCVD

Description:

This condition is true when a valid frame is received. It can be used for either the DTE or DCE side of the interface.

Type:

External

Example:

```
COND DCE RCVD
ACTN PROMPT "Frame received on DCE side"
```

Remarks:

None

BAD.FCS

Syntax:

DCE BAD.FCS
DTE BAD.FCS

Description:

This condition is true when a frame with a bad frame check sequence is received. It can be used for either the DTE or DCE side of the interface.

Type:

External

Example:

```
COND DTE BAD.FCS
ACTN PROMPT "The frame has bad FCS"
```

Remarks:

None

ABORT

Syntax:

DCE ABORT
DTE ABORT

Description:

This condition is true when either an aborted frame or an aborted frame check sequence—following the previous flag—is received. It can be used for either the DTE or DCE side of the interface.

Type:

External

Example:

```
COND DTE ABORT
     TIMEOUT count.down OR
ACTN PROMPT "Aborted frame or timeout"
```

Remarks:

None

FRAME ERROR

Syntax:

DCE FRAMING.ERROR
DTE FRAMING.ERROR

Description:

This condition is true when a framing error is detected. It can be used for either the DTE or DCE side of the interface.

Type:

External

Example:

```
COND DTE FRAMING.ERROR
ACTN PROMPT "FRAME ERROR. Evaluate now!"
```

Remarks:

None

RTS

Syntax:

RTS ON
RTS OFF

Description:

This condition is true when the Request To Send (RTS) pin makes a transition to the specified state. The valid states are ON and OFF.

Type:

External

Example:

```
COND RTS ON
ACTN PROMPT "RTS pin is on"
```

Remarks:

None.

CTS

Syntax:

CTS ON
CTS OFF

Description:

This condition is to true when the Clear To Send (CTS) pin makes a transition to the specified state. The valid states are ON and OFF.

Type:

External

Example:

```
COND CTS OFF
ACTN PROMPT "CTS is now off"
```

Remarks:

None.

CD

Syntax:

CD ON
CD OFF

Description:

This condition is true when the Carrier Detect (CD) pin makes a transition to the specified state. The valid states are ON and OFF.

Type:

External

Example:

```
COND CD ON
ACTN PROMPT "CD pin on"
```

Remarks:

None

DTR

Syntax:

DTR ON
DTR OFF

Description:

This condition is true when the Data Terminal Ready (DTR) pin makes a transition to the specified state. The valid states are ON and OFF.

Type:

External

Example:

```
COND DTR OFF
ACTN PROMPT "DTR switched off"
```

Remarks:

None

DSR

Syntax:

DSR ON
DSR OFF

Description:

This condition is true when the Data Set Ready (DSR) pin makes a transition to the specified state. The valid states are ON and OFF.

Type:

External

Example:

```
COND DSR OFF
     TIMEOUT count.down OR
ACTN PROMPT "DSR pin low or timeout occurred"
```

Remarks:

None

RI

Syntax:

RI ON
RI OFF

Description:

This condition is true when the Ring Indicator (RI) pin makes a transition to the specified state. The valid states are ON and OFF.

Type:

External

Example:

```
COND RI ON
ACTN RESET count.frame
```

Remarks:

None

HSV24/V35.3. Protocol Action Keywords

The protocol action keywords allow you to manipulate (drive) the interface control leads—overriding the settings on the Control Lead Setup screen—as well as flood a network. The protocol action keywords available for manipulating control leads are:

- RTS
- CTS
- CD
- DTR
- DSR
- RI

The protocol action keywords available for network flooding are:

- FLOOD.NETWORK
- STOP.FLOOD.NETWORK

The discussion of each keyword includes a syntactical model, a description and an example of its use.

> **Note:**
>
> Using PAL to override the Control Lead Setup Screen is only valid when Test Function on the Line Setup is set to Emulate. If emulating a DTE, RTS and DTR are valid keywords. If emulating a DCE, the valid keywords are CTS, CD, DSR and RI.

Since the protocol action keywords allow you to freely drive control leads ON or OFF, it is possible to inadvertently violate the RS-232C/V.24 and V.35 rules of control lead handshaking that are required for data transmission. At the same time, this freedom allows you to emulate/test for atypical or erroneous control lead handshaking.

RTS

Syntax:

RTS ON
RTS OFF

Description:

This action drives the Request To Send (RTS) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:

```
COND DSR ON
ACTN RTS ON
```

Remarks:

None

CTS

Syntax:

CTS ON
CTS OFF

Description:

This action drives the Clear To Send (CTS) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:

```
COND DSR OFF
ACTN CTS ON
```

Remarks:

None

CD

Syntax:

CD ON
CD OFF

Description:

This action drives the Carrier Detect (CD) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:

```
COND DSR ON
ACTN CD ON
```

Remarks:

None

DTR

Syntax:

DTR ON
DTR OFF

Description:

This action drives the Data Terminal Ready (DTR) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:

```
COND DSR ON
ACTN DTR OFF
```

Remarks:

None

DSR

Syntax:

DSR ON
DSR OFF

Description:

This action drives the Data Set Ready (DSR) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:

```
COND RI OFF
     TIMED count.down OR
ACTN DSR ON
```

Remarks:

None

RI

Syntax:

RI ON
RI OFF

Description:

This action drives the Ring Indicator (RI) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:

```
COND DSR ON
ACTN RI OFF
```

Remarks:

None

FLOOD.NETWORK

Syntax: FLOOD.NETWORK

Description: This action saturates the network with a user-defined string. In addition, the time interval between the frames may be selected (with 1 microsecond resolution) to control the saturation level of the network.

Example:

```
FLOOD.NETWORK "string"      TIME.GAP    [microseconds]
```

Remarks: None

STOP.FLOOD.NETWORK

Syntax: STOP.FLOOD.NETWORK

Description: This action stops the flood of the network after the current frame has been completely transmitted.

Example:

```
STOP.FLOOD.NETWORK
```

Remarks: None

RS-449 / V.36 Interface Operation Errata Sheet
March 1994

This is an errata sheet to the RS-449 / V.36 Interface Operation document, which is located in the *Line Interface Operation* binder.

As of Release 3.4.2, the maximum frame size on high speed WAN interfaces is 3984 bytes. The maximum frame size on standard WAN interfaces is 4012 bytes. This refers to the maximum frame size that can be displayed, not the maximum frame size that can be captured by the DA-3x. If a frame longer than the size limit is received, its length is displayed as the maximum length (3984 or 4012), and only that number of bytes is displayed in the frame detail and character trace. All frames, including those that exceed the maximum frame size, can be captured by the DA-3x.

Frame size references are made on the following pages of the RS-449/V.36 document.

Section V36.7.1.1: Receiver (or Playback) Activity

page V.36-28:

- Longest Frame - the size (in bytes) of the longest frames that has been received since receiving began. The maximum frame size that can be received is 4012 bytes.

Section HSV36.5.1.1: Receiver Activity

page HSV.36-19:

Note:
The maximum receive frame size is 3984 bytes.

Third Edition October 1993 Release 3.4 and after

V.36

RS-449 / V.36 Interface Operation

V36.1. Introduction

The RS-449/V.36 Interface gives the DA-30 the ability to monitor and/or emulate a DTE or DCE on a Wide Area Network (WAN). Figure V36-1 shows where the DA-30 fits into a WAN communications system.

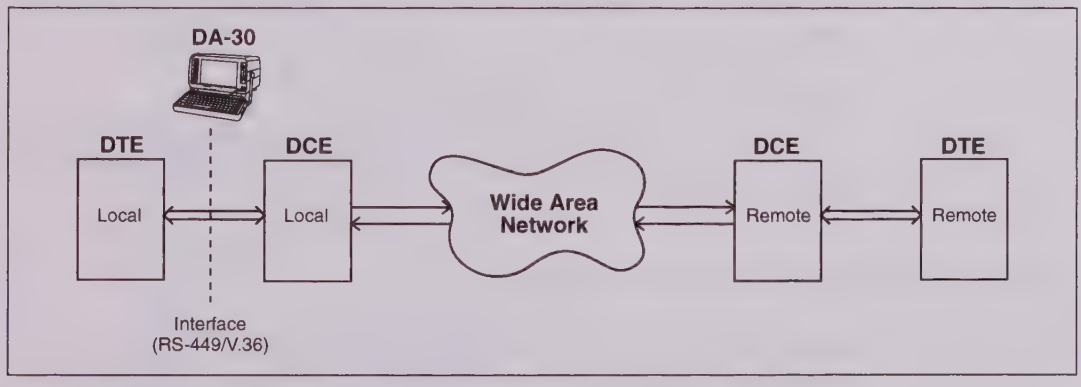


Figure V36-1 DA-30 in a WAN Communications System

The RS-449/V.36 Interface provides for three operating modes: emulate DTE, emulate DCE, and monitor. It can also transmit and receive using both synchronous and asynchronous data formats.

This document describes the installation, external connections, and the software setup for the RS-449/V.36 Line Interface Module.

V36.2. Installation

The RS-449/V.36 Interface derives its basic functionality from the following:

- Line Interface Module (LIM)—circuit board
- WAN Feature Module
- Line Interface Package (LIP)
- Layer Protocol Package (LPP)

> **Note:**
>
> Before you can use the RS-449/V.36 Interface, you must also have a Protocol Analyzer Module and a WAN Feature Module installed.

V36.2.1. Installing the LIM and Installing LIP & LPP Software on the Hard Disk

Installing the LIM:

For instructions on how to install the RS-449/V.36 LIM, refer to the installation procedures described in the "Installing Hardware Accessories" appendix of the *DA-30/31 Operating Manual*.

Installing the LIP & LPP Software:

For instructions on how to install the LIP & LPP software onto the hard disk, refer to the installation procedures described in the "Installing Software" appendix of the *DA-30/31 Operating Manual*.

V36.2.2. Loading the LIP & LPP Software

Before using your DA-30 for WAN testing, you should load the LPP software on the OSI protocol stack and then load the LIP software in the card slot containing the LIM.

To load the LPP software:

From the Main Menu, access the protocol stack by moving the cursor to the Active Protocols field within the current Analyzer window and pressing F2 (protocol stack). When the protocol stack appears, move the cursor to the Physical Layer (1), press F1 (view options), and select the RS449_V.36 package from the list.

To load the LIP software:

Move the cursor to the card slot window that corresponds to the slot containing the LIM. Press F1 (view options). Move the cursor to the RS449_V.36 package and press Enter.

V36.3. Making The Connections

A DB37 four-connector cable is provided so that you can make the necessary interface connections for your testing. See Figure V36-2. The four-connector cable has two, 37-pin connectors on each end. One is male, and the other is female to give you connection flexibility. The same signals are available on all of the connectors. For some testing configurations, you may need an additional DB37 cable.

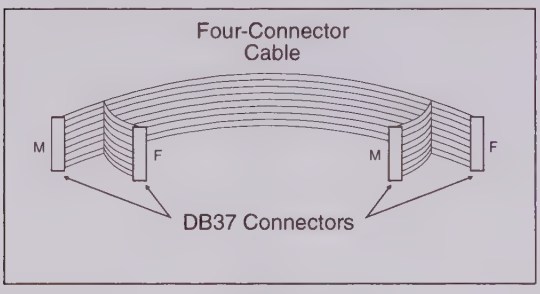


Figure V36-2 Four-Connector Cable

V36.3.1. The Rear Panel

Figure V36-3 shows the rear panel of the RS-449/V.36 Line Interface Module.

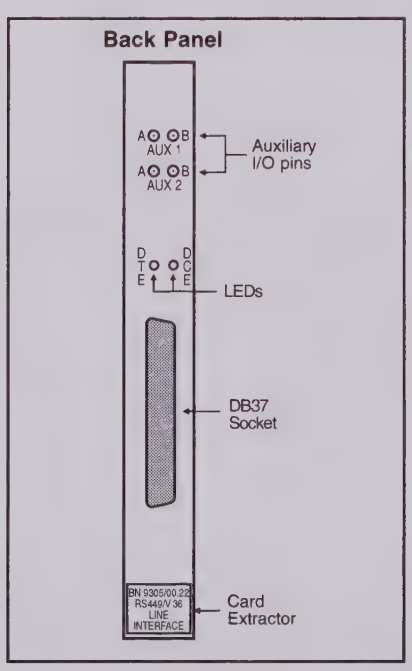


Figure V36-3 Rear Panel of RS-449/V.36 Line Interface Module

V36.3.1.1. Connector

The LIM provides one 37-pin (DB37) female connector on the rear panel.

V36.3.1.2. Connector LEDs

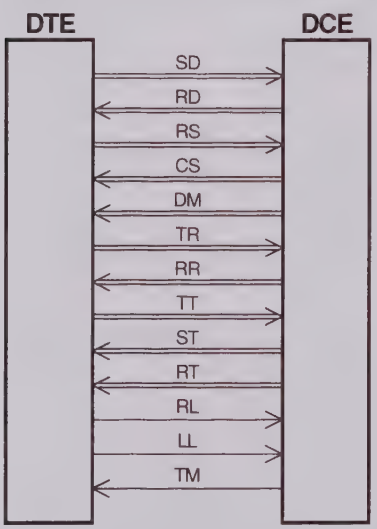
Above the DB37 connector are two green LEDs. The left LED is labelled DTE, and the right LED is labelled DCE. These LEDs indicate the LIM's test mode as shown in Table 1.

DTE LED	DCE LED	Test Mode
OFF	OFF	Monitor
ON	OFF	Emulate DTE
OFF	ON	Emulate DCE

Table 1 Connector LEDs and the Test Mode

V36.3.1.3. Auxiliary I/O Pins

Only 13 of the 30 specified interface signals can actually be driven or monitored by the LIM. See Figure V36-4. The other 17 signals are simply passed from one connector to the other. Twelve LEDs on the front panel indicate the status of a corresponding signal. The front panel LEDs and LED Overlay are discussed in the Front Panel LEDs section.



Data & Control Signals for RS-449/V.36

Single arrows represent unbalanced signals.
Double arrows represent balanced signals.

Figure V36-4 Supported Interface Signals

In the event that you need to drive or monitor one of the other 17 signals, two auxiliary input/outputs – labelled AUX 1 and AUX 2 – are provided at the top of the rear panel. AUX 1 is used for balanced signals. AUX 2 is used for unbalanced signals – with one pin available to connect to a reference (default is DA-30's ground). The status of either of these input/outputs is displayed by the front-panel LED that is labelled U/A (User Assigned). These input/outputs are designed to be monitored/driven (one-at-a-time) under the control of a Network Event Program (NEP) with the use of interface-specific, PAL (Protocol Analysis Language)

keywords. The NEP and the RS-449/V.36 PAL keywords are described in the "RS-449/V.36 PAL Reference" section of the *DA-30/31 Line Interface Programming* binder. This binder is part of the *DA-30/31 Programming Documentation Set* which is sold separately.

V36.3.2. Connecting For Monitoring

In the monitoring configuration, the DB37 four-connector cable (supplied by W&G) is connected between the DTE and DCE. Depending on the distance between the DA-30 and the DTE-DCE interface being monitored, you may then connect one of the free ends of the four-connector cable to the LIM rear panel connector – either directly as shown in Figure V36-5 (a) or via a DB37 extension cable (user-supplied) as shown in Figure V36-5 (b).

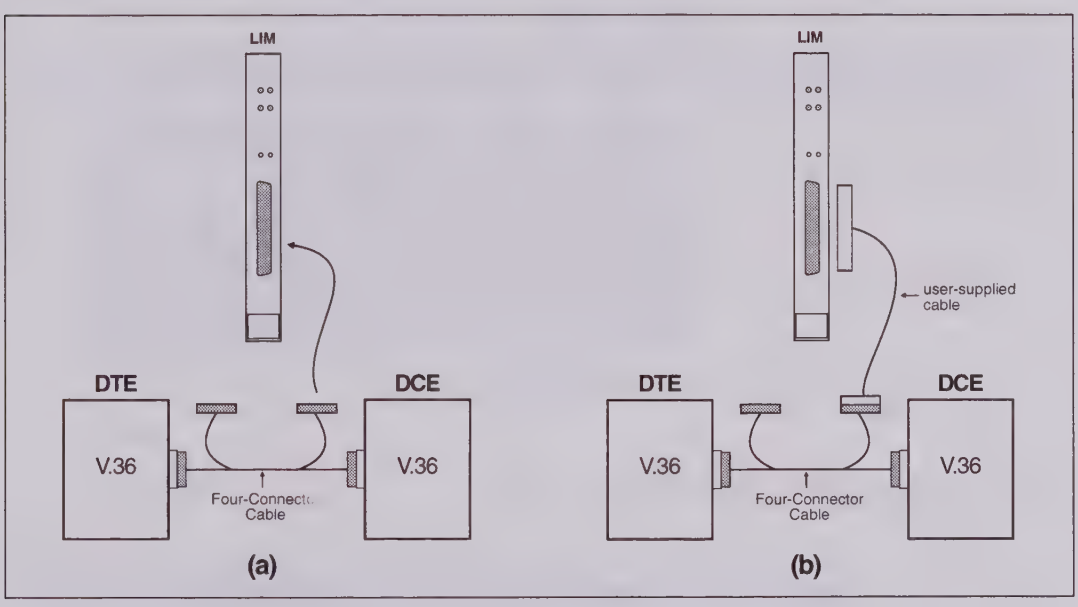


Figure V36-5 Monitoring Configuration (a) & (b)

V36.3.3. Connecting For DTE Emulation

When in the Emulate DTE mode, the LIM is used to test DCE devices. In the emulate DTE configuration, the four-connector cable is connected between the LIM and the DCE. See Figure V36-6.

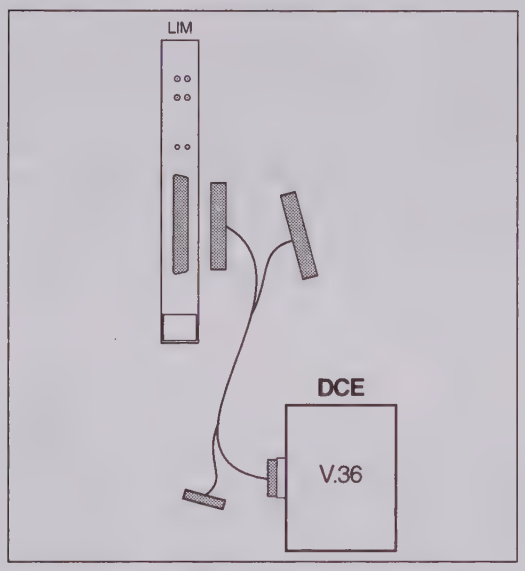


Figure V36-6 Emulate DTE Configuration

V36.3.4. Connecting For DCE Emulation

When in the Emulate DCE mode, the LIM is used to test DTE devices. In the emulate DCE configuration, the four-connector cable is connected between the LIM and the DTE. See Figure V36-7.

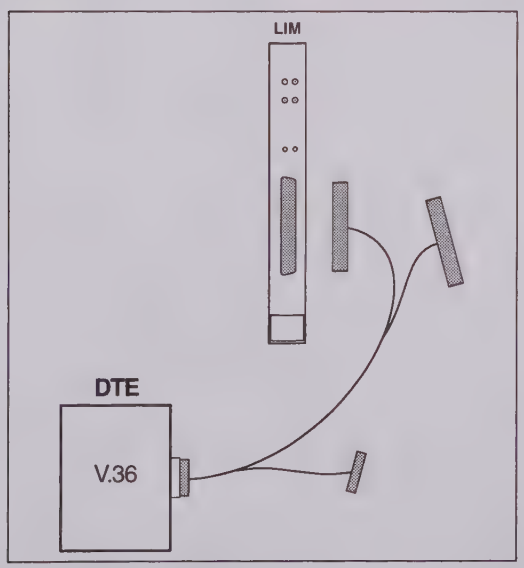


Figure V36-7 Emulate DCE Configuration

V36.4. Setting Up The Line Interface

By now, you have installed the LIM in the DA-30, installed and loaded the LIP and LPP software, and made the appropriate test connections for monitoring or emulation. You are now ready to setup the line interface for your particular test. To perform the setup, press F2 (line setup) to see the top level setup screen (RS449_V.36 Setup) shown in Figure V36-8. You may select either of the following three setup menus:

- Line Setup
- Control Lead Setup
- CRC Setup

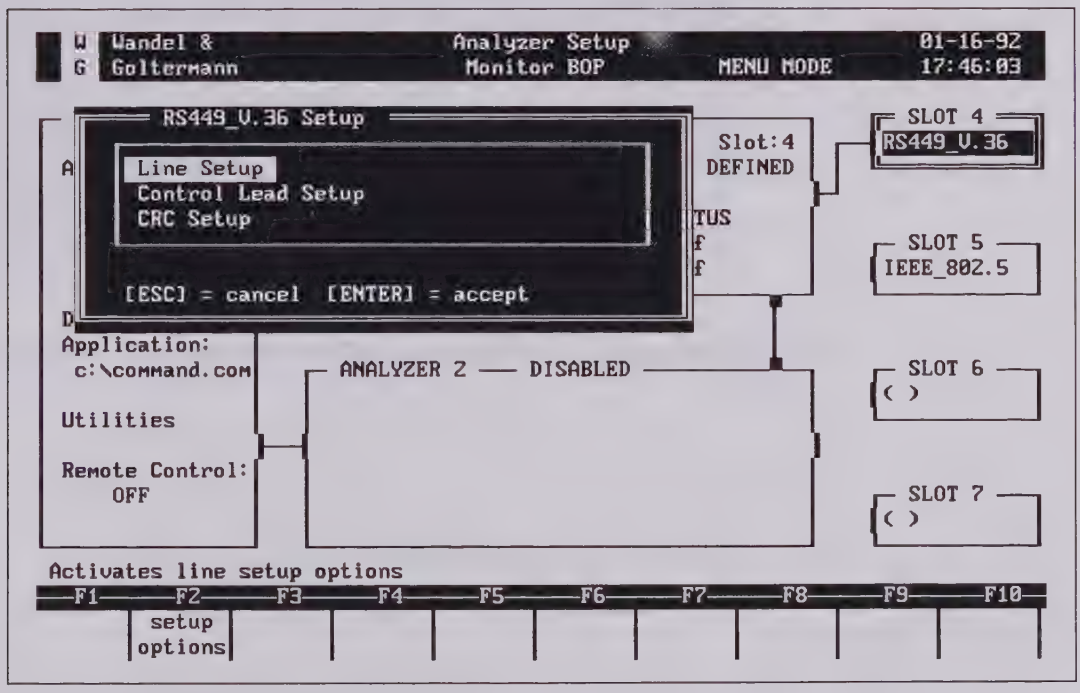


Figure V36-8 RS449_V.36 Setup Screen

V36.4.1. The Line Setup

The cursor should already be on Line Setup. Press F2 (setup options) to see the Line Setup menu shown in Figure V36-9.

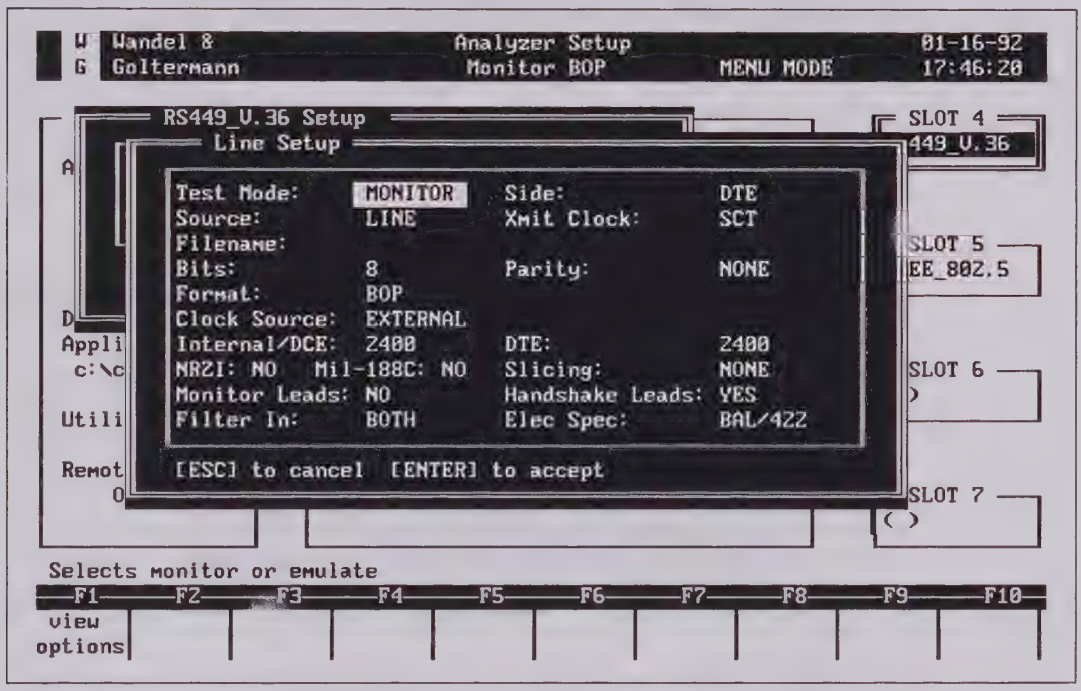


Figure V36-9 Line Setup

Line Setup menu allows you to configure the data line parameters.

V36.4.1.1. Test Mode

This field allows you to select between two modes of operation:

- MONITOR – the DA-30 passively monitors network activity on both sides of the DTE-DCE interface. Received data is also processed according to the Network Event Program (if defined).
- EMULATE – the DA-30 transmits network data and drives the appropriate control leads – depending on the type of emulation (DTE or DCE). Received data is also processed according to the Network Event Program (if defined).

V36.4.1.2. Side

When the selected Mode is EMULATE, this field allows you to select the side of the DTE-DCE interface to Emulate.

- DTE – the DA-30 emulates a DTE device while appropriately driving the RS, TR, and TT leads. This selection is used when testing DCE equipment (i.e. modem).
- DCE – the DA-30 emulates a DCE device while appropriately driving the CS, RR, DM, ST, and RT leads. This selection is used when testing DTE equipment (i.e. computer, terminal, etc.).

V36.4.1.3. Source

The DA-30 is able to analyze data from two sources:

- Line – The physical network is the source of the data.
- File – A logged data file is the source of the data.

V36.4.1.4. Xmit Clock

When the selected mode is EMULATE, you must choose the type of transmit timing. The choices are:

- SCT – the DA-30's internal clock is used for transmitting. Use this setting to emulate a DCE.
- SCTE – an external clock is used for transmitting. Use this setting to emulate either a DTE or DCE. When external clocking is used, the DCE expects to receive the TT clock (typically from the DTE). The DCE then loops it back to the DTE as ST and RT. See Figure V36-10.

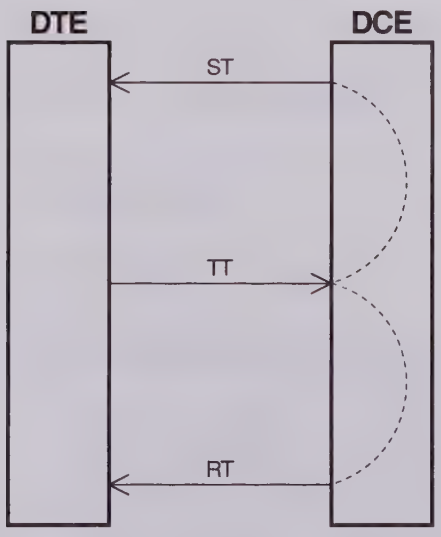


Figure V36-10 External Clocking for DCE or DTE Emulation

V36.4.1.5. Filename

When the Source is set to FILE, you enter the name of the logged data file. To see a list of available filenames to choose from, press F1 (view options). Use the cursor keys to highlight a filename and press Enter to load the file.

V36.4.1.6. Bits

This field allows you to select the number of bits per character. The options are:

- 8
- 7
- 6
- 5

The selections for 5, 6 and 7 bits are valid only for asynchronous transmission. Therefore, the Format setting (discussed later) should be ASYNC. This field is checked during program compilation. If BOP or SYNC is selected for Format, an error message will be displayed.

V36.4.1.7. Parity

This field allows you to select the type of parity error detection used. The options are:

- NONE – No parity checking.
- ODD – Odd parity is used. The combined data and parity bits should contain an odd number of ones.
- EVEN – Even parity is used. The combined data and parity bits should contain an even number of ones.
- MARK – Parity bit is always binary 1
- SPACE – Parity bit is always binary 0.

This field defaults to NONE.

Note:

NONE is the only valid selection when 8 is the selected number of bits per character.

V36.4.1.8. Format

This field allows you to select the data format being used by the device or system under test. Press F1 (view options) to see the following choices:

- BOP – For devices using Bit-Oriented Synchronous Protocols that use 7E-framing and zero insertion. Examples of these protocols are HDLC and SDLC.
- SYNC – For devices using Character-Oriented Synchronous Protocols. Examples of these protocols are BSC (Binary Synchronous Communications or Bisync) and DDCMP (Digital Data Communications Message Protocol).

Note:

Bisync is supported – not IBM Bisync.

- ASYNC – For devices using an Asynchronous transmission format.

The Format field defaults to BOP. Move the cursor to the desired data format and press Enter to make your selection. Configuration screens for each of the above data formats can be accessed from the Format softkey rack by pressing either F3 (bop setup), F4 (sync setup), or F5 (async setup). See Figure V36-11.

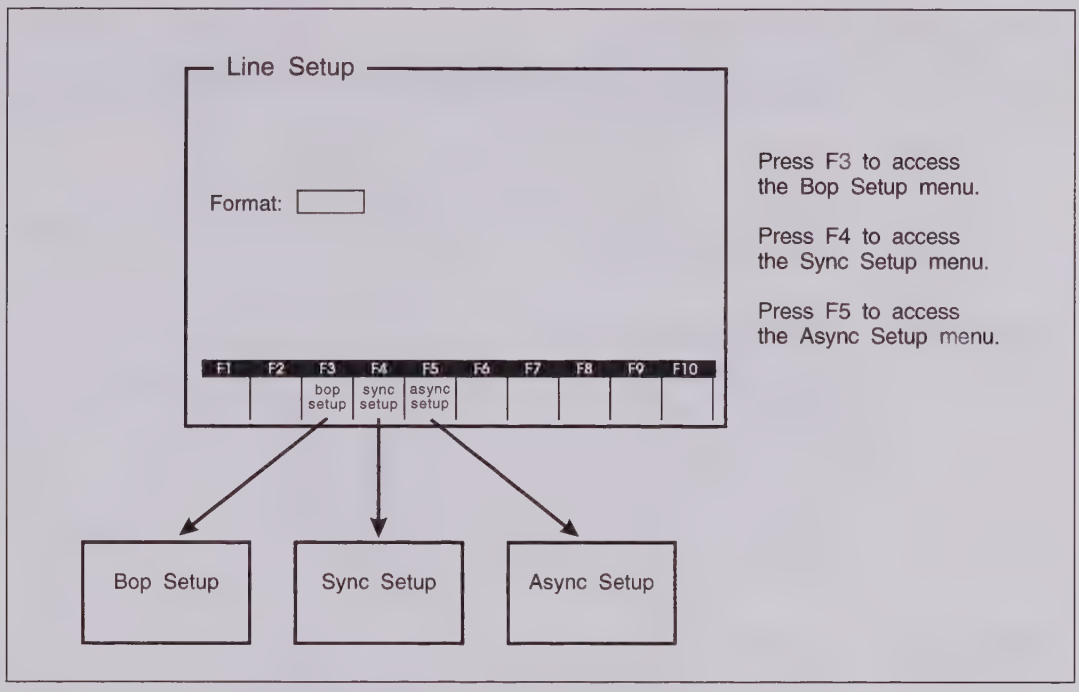

Line Setup
Format:
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
bop setup
sync setup
async setup
Press F3 to access the Bop Setup menu.
Press F4 to access the Sync Setup menu.
Press F5 to access the Async Setup menu.
Bop Setup
Sync Setup
Async Setup

Figure V36-11 Accessing Data Format Configuration Screen

V36.4.1.8.1. Bop Setup

Press F3 (bop setup) to change the default Bop settings shown in Figure V36-12.

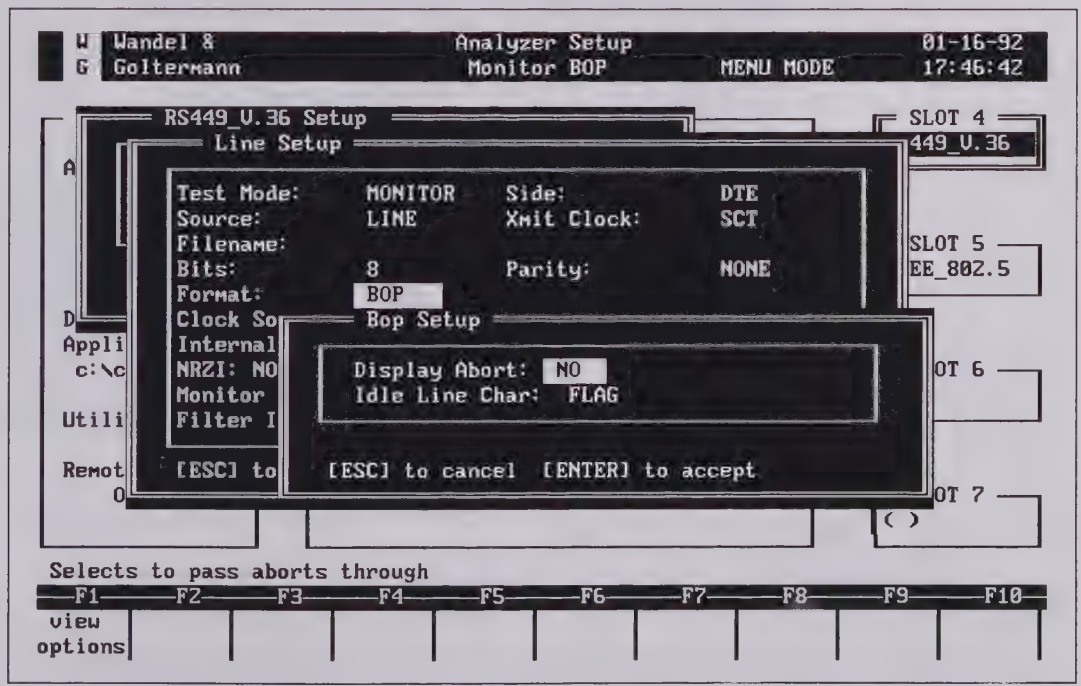


Figure V36-12 BOP Setup

V36.4.1.8.1.1 Display Abort

This field allows you to select whether or not Aborted frames trigger a specific event in the Network Event Program.

- NO
- YES

This field defaults to NO.

V36.4.1.8.1.2 Idle Line Character

This field allows you to select the character that the receiver interprets as an idle line (no data being transmitted).

- FLAG – Sets the Idle Line Character to 7E (hex).
- MARK – Sets the Idle Line Character to FF (hex).

The default Idle Line Character is FLAG (7E).

V36.4.1.8.2. Sync Setup

Press F4 (sync setup) to change the default Sync settings shown in Figure V36-13.

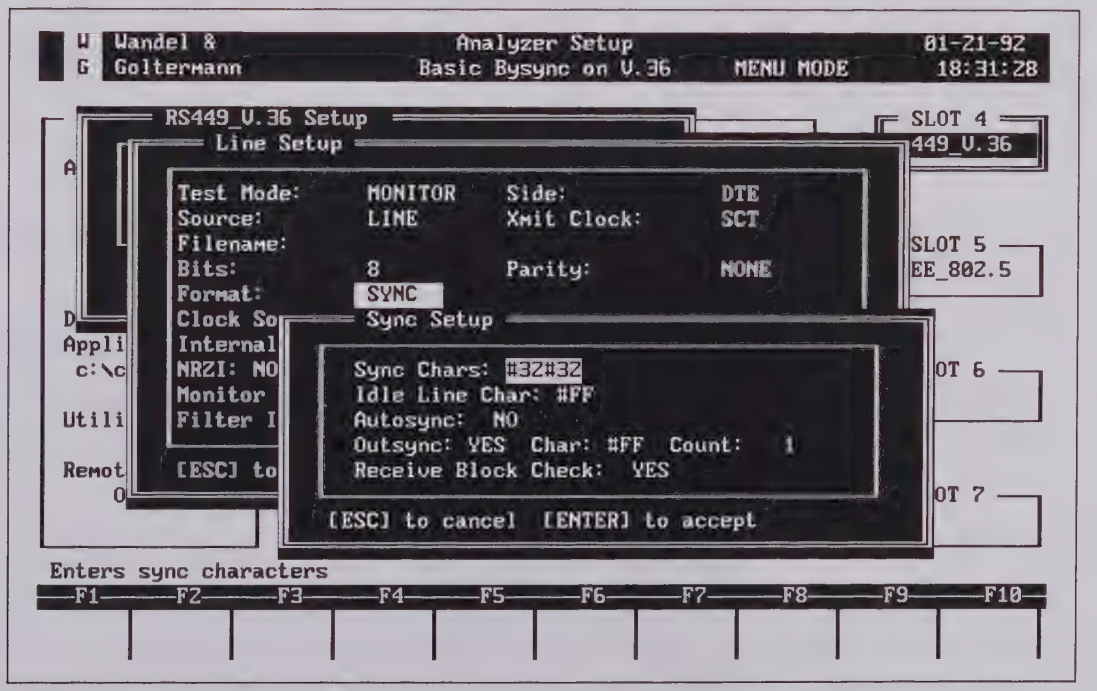


Figure V36-13 SYNC Setup

V36.4.1.8.2.1 Sync Characters

This field allows you to enter the hexadecimal characters the receiver uses to synchronize itself with the beginning of a frame. The format for this entry is:

#xx#xx where: # represents hexadecimal notation
xx is the character value

The default Synch Characters are #32#32.

V36.4.1.8.2.2 Idle Line Character

This field allow you to enter the Idle Line Character that is transmitted. This field is valid only when the Test Mode is set to Emulate. The format for this entry is:

#xx where: # represents hexadecimal notation;
xx is the character value

The default Idle Line Character is #FF.

V36.4.1.8.2.3 Autosync

This field allows you to select whether or not the receivers resynchronize each time the sync characters are detected.

- NO – The sync characters cause re-synchronization only if the receiver is out of sync.
- YES – Every occurrence of the sync characters causes re-synchronization.

This field defaults to NO.

V36.4.1.8.2.4 Outsync

This field allows you to select whether or not the receiver goes out of sync when it detects the Outsync character pattern.

- NO
- YES

This field defaults to YES.

V36.4.1.8.2.5 Character

This field allows you to select the character that the receiver interprets as the Outsync Character. The format is:

#xx where: # represents hexadecimal notation;
xx is the character value

The default Outsync Character is #FF.

V36.4.1.8.2.6 Count

This field determines the consecutive number of times the Outsync Character must be detected before the Outsync condition takes effect. The count can range from 1 to 999.

The default Outsync Count is 1.

V36.4.1.8.2.7 Receive Block Check

This field determines if CRC (Cyclic Redundancy Check) error detection is performed.

- NO – No CRC calculation is performed.
- YES – The receiver performs a CRC calculation according to the CRC Setup menu.

This field defaults to YES.

V36.4.1.8.3. Async Setup

Press F5 (async setup) to change the default Async settings. The Async Setup window is shown in Figure V36-14.

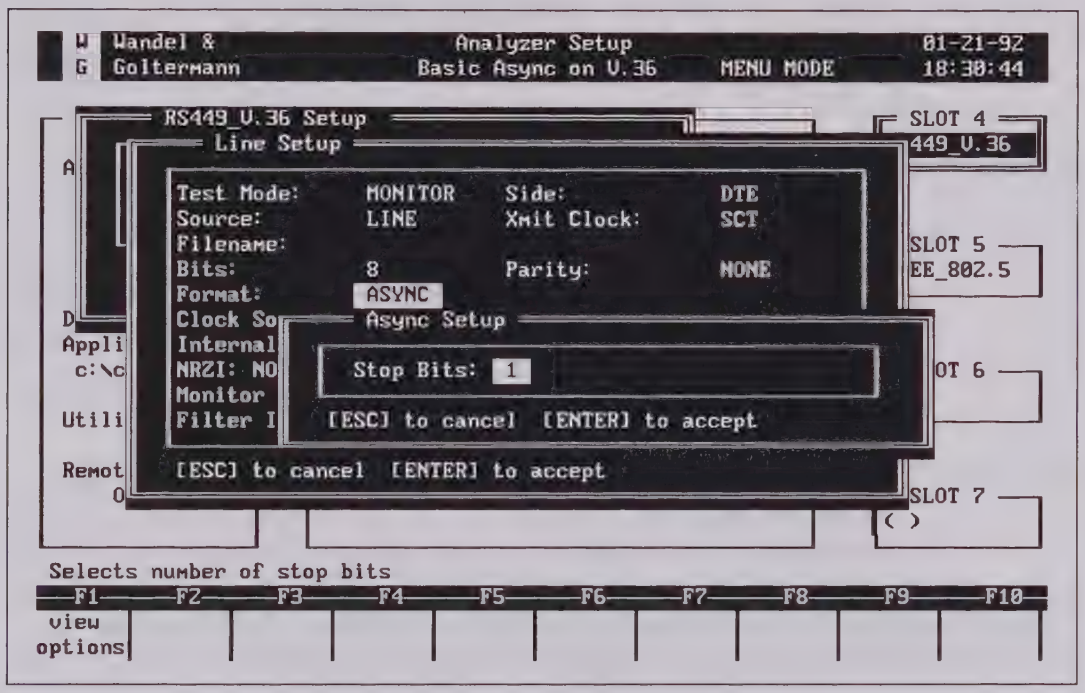


Figure V36-14 ASYNC Setup

V36.4.1.8.3.1 Stop Bits

This field allows you to select the minimum number of stop bits that terminate each data character. A stop bit is defined as a binary 1. The following choices are provided:

- 1 – Appends at least 1 stop bit at the end of each character.
- 2 – Appends at least 2 stop bits at the end of each character.

The default number of Stop Bits is 1.

The Stop Bits field, along with your selections for Bits and Parity, complete the asynchronous transmission setup. See Figure V36-15.

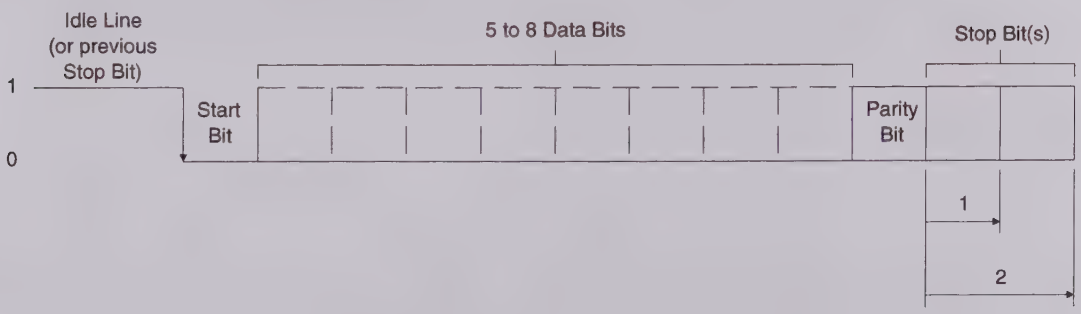


Figure V36-15 Asynchronous Transmission Format

The "Idle Line" state is also defined as a binary 1. When the transmitter is ready to send a character, it will send a start bit (binary 0) followed by the character (5 to 8 bits). It will then send a parity bit (if specified) and terminate transmission with the specified number of stop bits.

V36.4.1.9. Clock Source

- EXTERNAL – This setting is used when the DA-30 acts as a monitor between a DTE and a DCE – with the DA-30 clock being supplied by the DTE, DCE, or some other source.

  This setting can also be used when emulating a DTE or DCE. If emulating a DTE, the transmit and receive clocks (ST & RT) would typically be supplied by the DCE. If emulating a DCE, the transmit and receive clocks (ST & RT) are derived from an externally supplied transmit clock (TT). Be sure to set Xmit Clock to SCTE.

- INTERNAL – This setting is used when the DA-30 is emulating a DTE or DCE. If emulating a DTE, the DA-30 would provide the timing for the interface using the TT clock lead. The DCE uses TT to derive the transmit and receive clocks (ST & RT). If emulating a DCE, the DA-30 would provide the transmit and receive clocks (ST & RT) for the interface.

  This setting must be used whenever using the ASYNC data format. ASYNC means there is no clock on the interface leads and the DA-30 will not look for an external clock.

- INTERNAL SPLIT – This setting is used when you are monitoring or emulating a DCE in an asynchronous system where different baud rates are used for receive and transmit data. This setting can also be used when emulating a DCE on dual-speed, synchronous lines (ST & RT) are clocked at different rates.

V36.4.1.10. Internal/DCE

This field allows you to enter the data line speed (in bits/sec) when the Test Mode is set to EMULATE.

- If the selected Clock Source is INTERNAL, this field is used to set the speed for both the ST & SR clocks when emulating a DCE. If emulating a DTE, it is used to set the speed for the TT clock. See Figure V36-16.

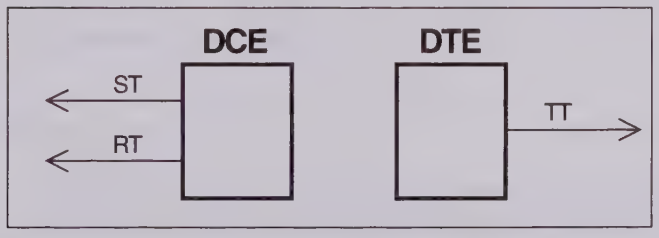


Figure V36-16 Setting Clock Rate for Internal Clock Source

- If the selected Clock Source is INTERNAL SPLIT, this field is used to set the speed for the RT clock as shown in Figure V36-17. This field defaults to 2400 and is used only when emulating a DCE.

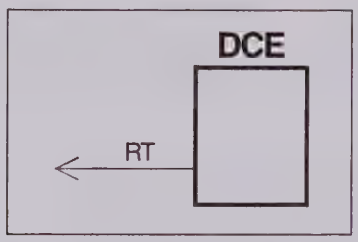


Figure V36-17 Setting Clock Rate for Internal Split Clock Source (DCE)

V36.4.1.11. DTE

This field allows you to enters the data line speed (in bits/sec) when the selected Mode is EMULATE.

- If the selected Clock Source is INTERNAL SPLIT, this rate is used only for the DTE side of the data line as shown in Figure V36-18. It is otherwise unused. This field defaults to 2400.

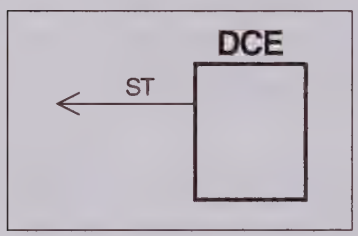


Figure V36-18 Setting Clock Rate for Internal Split Clock Source (DTE)

V36.4.1.12. NRZI – Non Return to Zero Inverted

This field allows you to select whether or not Non Return to Zero Inverted data encoding is performed.

- NO
- YES

In the NRZI encoding scheme, the line polarity is inverted with the transmission of each binary 0. The line polarity does not change, however, with the transmission of a binary 1. See Figure V36-19.

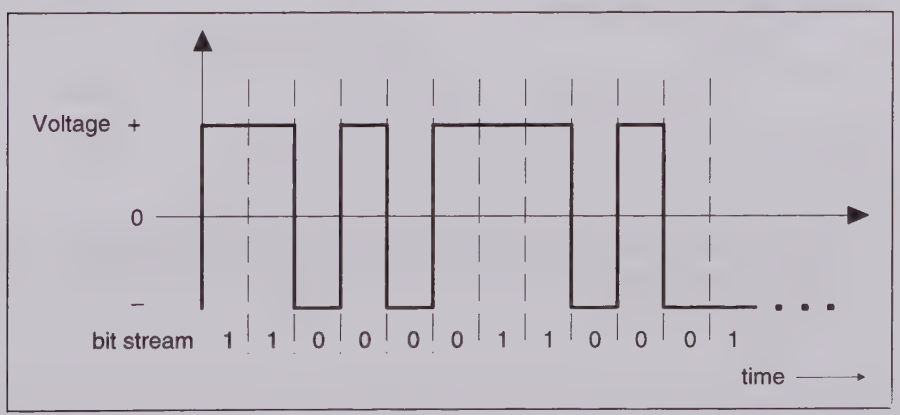


Figure V36-19 NRZI Encoding Example

This field defaults to NO.

V36.4.1.13. Mil-188C

This field allows you to select whether or not to invert the data signals (SD and RD).

- NO
- YES

This field defaults to NO.

V36.4.1.14. Slicing

Frame Slicing allows you to shorten a data frame before it is passed to the protocol analyzer for processing. This is useful when you are only interested in certain parts of a frame (i.e frame headers). Frame slicing is not valid when using the ASYNC data format.

- NONE – The entire frame is passed.
- 32 – Only the first 32 bytes of a frame are passed.
- 64 – Only the first 64 bytes of a frame are passed.
- 128 – Only the first 128 bytes of a frame are passed.
- 256 – Only the first 256 bytes of a frame are passed.
- 512 – Only the first 512 bytes of a frame are passed.
- 1024 – Only the first 1024 bytes of a frame are passed.

Frame slicing also allows you to maximize the amount of protocol information that is written to the capture buffer or to the hard disk (when logging). Although no data beyond the specified size is passed to the protocol analyzer, CRC checking is performed for the entire frame.

> **Note:**
>
> Be careful not to slice a frame in the middle of a protocol header – making the protocol invalid for decoding.

This field defaults to NONE.

V36.4.1.15. Monitor Leads

This field allows you to monitor the activity of the data and control leads (SD, RD, RS, CS, RR, TR, DM). During Run Mode, the waveform for each control lead is displayed on the Network Status screen.

- NO – The control leads are not monitored.
- YES – The control leads are monitored.

This field defaults to NO.

V36.4.1.16. Handshake Leads

This field allows you to select whether or not control lead handshaking is to be performed when the selected Test Mode is EMULATE. The control leads must be set to ON or SWITCHED in the Control Lead Setup menu.

- NO – No control lead handshaking is performed during data transmission.
- YES – Control lead handshaking is performed based on the settings on the Control Lead Setup menu and the selected Side (DTE or DCE) of the interface that is being emulated. A warning is displayed if there is an invalid control lead setting.

This field defaults to YES.

V36.4.1.17. Filter In

The received data that is processed by the analyzer can come from either or both sides of the interface. This field allows you to make that selection. Press F1 (view options) for the following choices:

- BOTH – Signals from both the DTE and the DCE sides of the interface are passed to the analyzer for processing.
- DTE – Only signals from the DTE side of the interface are passed up to the analyzer for processing.
- DCE – Only signals from the DCE side of the interface are passed up to the analyzer for processing.

This field defaults to BOTH.

V36.4.1.18. Elec Spec

This field allows you to select the RS-449 electrical specification to use. The choices are:

- BAL/422 – The RS-422 electrical specification is used. The SD, RD, ST, RT, TT, CS, RS, TR, RR and DM leads are balanced. The TM, RL and LL leads are unbalanced.
- UNBAL/423 – The RS-423 electrical specification is used. All leads are unbalanced.
- MIXED – Both the RS-422 and RS-423 electrical specifications are used. The SD, RD, ST, RT and TT are balanced. The CS, RS, TR, RR, DM, TM, RL and LL are unbalanced.

This field defaults to BAL/422.

V36.4.2. Control Lead Setup

From the Top Level setup screen, move the cursor to Control Lead Setup and press F2 (lead options) to see the Control Lead Setup menu shown in Figure V36-20.

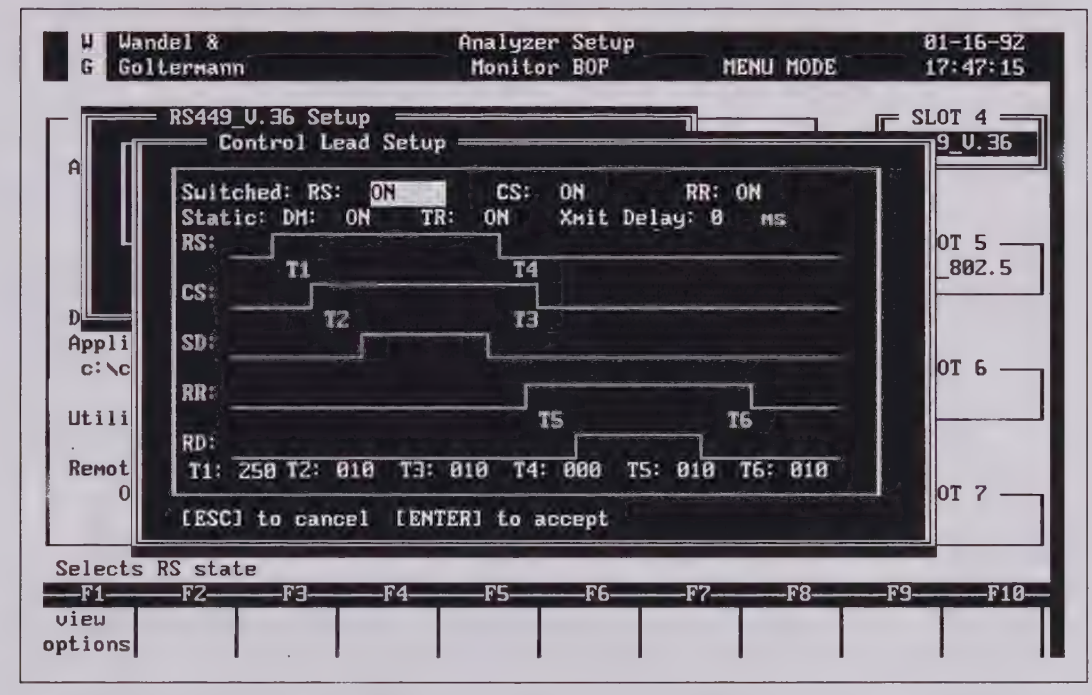


Figure V36-20 Control Lead Setup

The Control Lead Setup menu allows you to configure the initial state of the control leads as well as set the timing relationships between them.

These settings are used only when the Test Mode (on the Line Setup menu) is set to EMULATE.

V36.4.2.1. Switched RS (Request To Send)

This field allows you to select how the RS control lead behaves during Run Mode. The RS lead can be controlled only when emulating a DTE.

- OFF – The lead is driven LOW. If emulating a DCE, the DA-30 turns RR ON to transmit without waiting for CS OFF.
- ON – The lead is driven HIGH. If emulating a DCE, the DA-30 turns RR ON to transmit without waiting for CS OFF.
- SWITCH – The lead is turned ON and OFF under the control of the LIP. The initial state is OFF. The DA-30 waits for CS ON before transmitting (on TD). RS is turned ON before each transmission and is turned OFF at the end of each transmission. The DA-30 will wait for CS OFF before turning RS ON for a new transmission.

If emulating a DCE (and CS & RR are SWITCHed), the DA-30 will wait for CS OFF before turning RR ON to transmit.

> You may specify a delay that the DA-30 waits before turning RS ON after test conditions have been satisfied. See the Xmit Delay field.

You may also specify the delay that the DA-30 waits before turning RS OFF at the end of transmission. See the T3 field.

V36.4.2.2. Switched CS (Clear To Send)

This field allows you to select how the CS control lead behaves during Run Mode. The CS lead can be controlled only when emulating a DCE.

- OFF – The lead is driven LOW. If emulating a DTE, the DA-30 will transmit (on TD)--ignoring the CS OFF condition.
- ON – The lead is driven HIGH. If emulating a DTE, the DA-30 will transmit (on TD) without waiting for CS ON.
- SWITCH – The lead is turned ON and OFF under the control of the LIP. The initial state is OFF. If emulating a DTE, the DA-30 will wait for CS ON before transmitting (on TD).

  You may specify a delay that the DA-30 waits before turning CS ON after detecting RS ON. See the T1 field.

  You may also specify a delay that the DA-30 waits before turning CS OFF after detecting RS OFF. See the T4 field.

V36.4.2.3. Switched RR (Receiver Ready)

This field allows you to select how the RR control lead behaves during Run Mode. The RR lead can be controlled only when emulating a DCE.

- OFF – The lead is driven LOW. If emulating a DTE, the DA-30 will turn RS ON for a new transmission without waiting for CS OFF.
- ON – The lead is driven HIGH. If emulating a DTE, the DA-30 will turn RS ON for a new transmission without waiting for CS OFF.
- SWITCH – The lead is turned ON and OFF under the control of the LIP. The initial state is OFF. If CS is ON (in response to RS ON), RR will not be turned ON until CS goes OFF. If emulating a DTE, the DA-30 will wait for CS OFF before turning RS ON for a new transmission.

  You may specify a delay that the DA-30 waits before turning RR ON after test conditions have been satisfied. See the Xmit Delay field.

  You may also specify a delay that the DA-30 waits before transmitting data (on RD) after turning RR ON. See the T5 field.

  You may also specify a delay that the DA-30 waits before turning RR OFF at the end of transmission. See the T6 field.

V36.4.2.4. Static DM (Data Mode)

This field allows you to select how the DM control lead behaves during Run Mode. The DM lead can be controlled only when emulating a DCE.

- ON – The lead is driven HIGH.
- OFF – The lead is driven LOW.

This field defaults to ON.

V36.4.2.5. Static TR (Terminal Ready)

This field allows you to select how the TR control lead behaves during Run Mode. The TR lead can be controlled only when emulating a DTE.

- ON – The lead is driven HIGH.
- OFF – The lead is driven LOW.

This field defaults to ON.

V36.4.2.6. Xmit Delay

This field allows you to set the delay (in milliseconds) between the time the DA-30 becomes ready to transmit (generate or playback) and the time it indicates its readiness to transmit (by raising the appropriate control lead). See Figure V36-21.

- When emulating DTE, the RS lead is driven HIGH.
- When emulating DCE, the RR lead is driven HIGH.

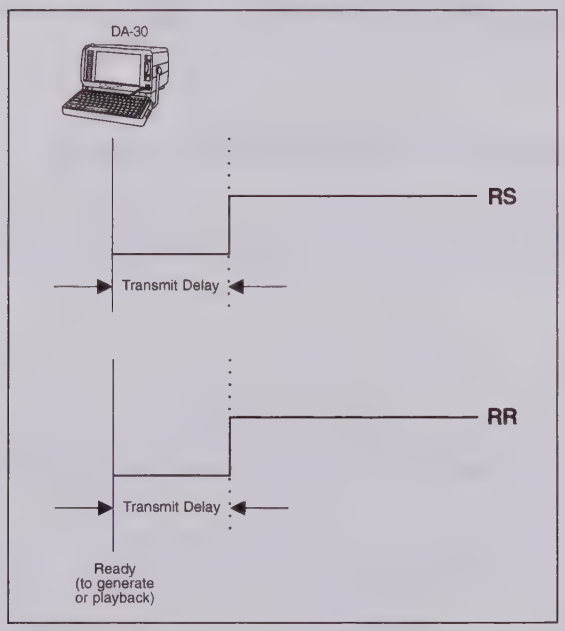


Figure V36-21 Transmit Delay

The delay can range from 0 to 999 milliseconds and defaults to 0 ms.

V36.4.2.7. T1

This field allows you to set the amount of time (in milliseconds) that the DA-30 will wait before turning CS ON after detecting RS ON. This delay applies only when emulating a DCE.

The delay can range from 0 to 999 milliseconds and defaults to 250 ms.

V36.4.2.8. T2

This field allows you to set the amount of time (in milliseconds) that the DA-30 will wait before transmitting (on SD) after detecting CS ON. This field applies only when emulating a DTE.

The delay can range from 0 to 999 milliseconds and defaults to 10 ms.

V36.4.2.9. T3

This field allows you to set the amount of time (in milliseconds) that the DA-30 will wait before turning RS OFF after it has stopped transmitting. This field applies only when emulating a DTE.

The delay can range from 0 to 999 milliseconds and defaults to 10 ms.

V36.4.2.10. T4

This field allows you to set the amount of time (in milliseconds) that the DA-30 will wait before turning CS OFF after detecting RS OFF. This field applies only when emulating a DCE.

The delay can range from 0 to 999 milliseconds and defaults to 0 ms.

V36.4.2.11. T5

This field allows you to set the amount of time (in milliseconds) that the DA-30 will wait before transmitting (on RD) after turning RR ON. This field applies only when emulating a DCE.

The delay can range from 0 to 999 milliseconds and defaults to 10 ms.

V36.4.2.12. T6

This field allows you to set the amount of time (in milliseconds) that the DA-30 will wait before turning RR OFF after it has stopped transmitting. This field applies only when emulating a DCE.

The delay can range from 0 to 999 milliseconds and defaults to 10 ms.

V36.4.3. CRC (Cyclical Redundancy Check) Setup

From the Top Level setup screen, move the cursor to CRC Setup and press F2 (crc options) to see the CRC Setup menu shown in Figure V36-22.

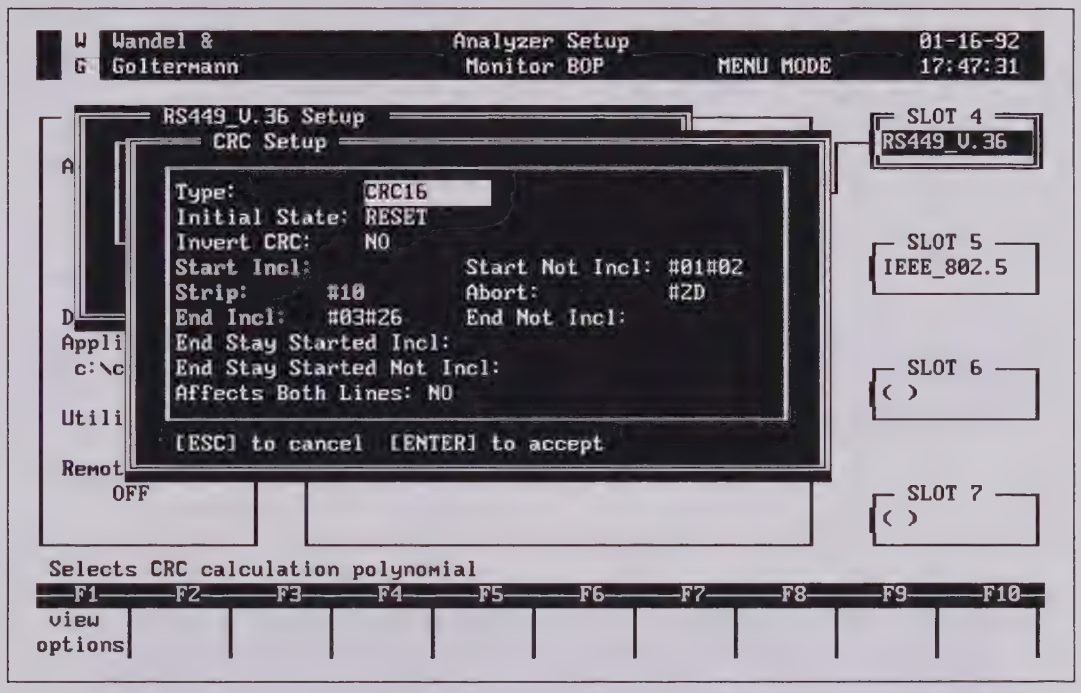


Figure V36-22 CRC Setup

The CRC calculator has a Start state and an Accumulate state. In the Start state, the calculator waits for the character that starts the calculation. In the Accumulate state, the calculator performs the calculation according to the CRC polynomial.

The calculator changes from the Start state to the Accumulate state on the first Start character it detects. Subsequent Start characters that are detected – once in the Accumulate state – are treated as normal characters in the data stream. When an End character is detected, the calculation stops, and the CRC calculator compares its calculation to the frame's transmitted FCS value. Based on this comparison, the frame is then evaluated as Good or Bad. The calculator then returns to the Start state.

The CRC calculator is used for the ANSI Bisync protocol only. Therefore, the CRC Setup screen defaults to an ANSI Bisync CRC check. So, when using the CRC calculator, be sure to set Format to SYNC on the Line Setup menu.

The ANSI Bisync default settings and their explanations are shown in Table 2.

FIELD	DEFAULT	EXPLANATION
Type	CRC16	The $x^{16} + x^{15} + x^2 + 1$ polynomial is used.
Initial State	RESET	The CRC is initially set to all zeros.
Invert CRC	NO	The polarity of the CRC is unchanged.
Start Incl	Blank	N/A
Start Not Incl	#01#02 (See Note)	The occurrence of **either** of these characters (01 or 02) in the data stream triggers the CRC calculation on the received frame. They are not included in the CRC calculation.
Strip	#10 (See Note)	This character is excluded (Stripped) from the CRC calculation.
Abort	#2D (See Note)	This character causes the CRC calculator to abort the current calculation. The current frame is then flagged as an aborted frame, and the calculator returns to the Start state.
End Incl	#03#26 (See Note)	The occurrence of **either** of these characters (03 or 26) in the data stream triggers the end of the CRC calculation. These characters are included in the CRC calculation. The CRC calculator then compares its calculation to the frame's FCS value. Based on this comparison, the frame is then evaluated as Good or Bad, and the calculator returns to the Start state.
End Not Incl	Blank	N/A
End Stay Started Incl	Blank	N/A
End Stay Started Not Incl	Blank	N/A
Affects Both Lines	NO	When an Abort character is detected, the CRC calculation aborts only the side (DTE or DCE) of the data line that generated the Abort.

Note: # denotes hexadecimal notation.

Table 2 Default CRC Settings

V36.5. TESTPREP Consistency Check

After you have the completed the interface setup (Line Setup, Control Lead Setup, and CRC Setup) and returned to the Main menu, you can run your current application by going to the Run Mode (press the Alt-Run keys). Before going from the Menu Mode to the Run Mode, the DA-30 runs a program called TESTPREP that checks to see if all your setup entries are consistent before compiling and running your application. If you have inadvertently created an inconsistent setup, TESTPREP flags the problem. A warning message will appear offering you the option of returning to Menu Mode to correct the inconsistent settings or allowing the DA-30 to change them for you. See Figure V36-23. If you choose the latter, the change takes effect in Run Mode only; that is, the menu selection is not physically altered. Running the application again without making the necessary correction(s) in the setup menus produces the same results. Therefore, upon seeing the warning message, you may wish to return to Menu Mode, correct the inconsistency, and save the application before running again.

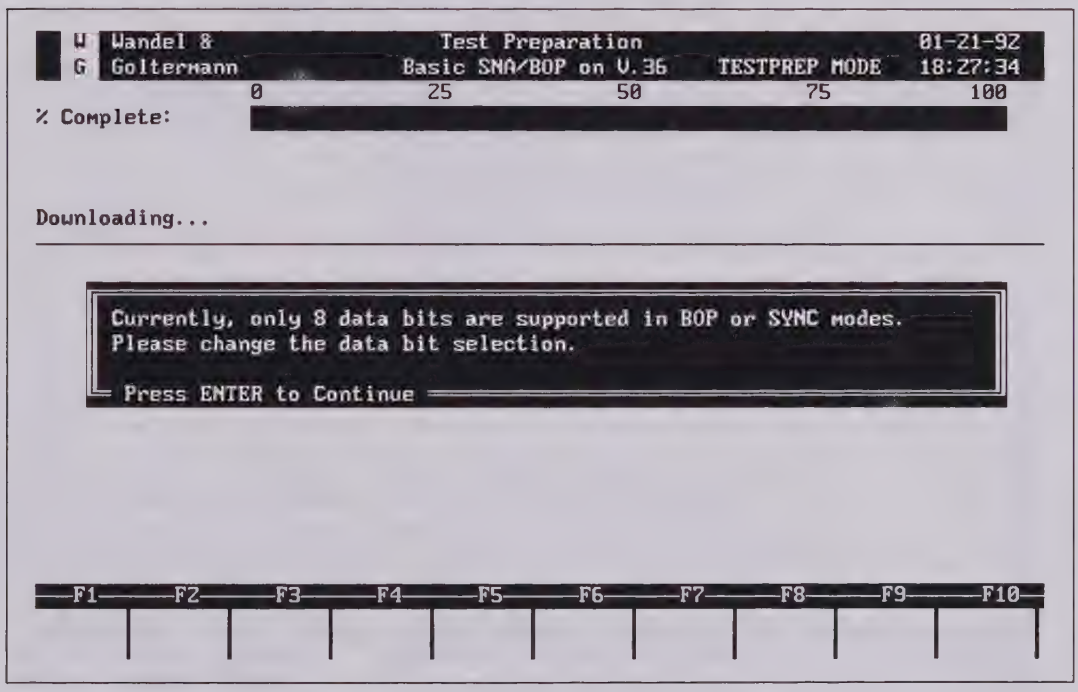


Figure V36-23 TESTPREP Warning

V36.6. Front Panel LEDs

There are 12 front panel LEDs. Eleven of these indicate the status of a corresponding interchange circuit on the RS-449/V.36 interface. A twelfth LED is provided to indicate the status of one of the two auxiliary input/outputs (AUX 1 & AUX 2) on the rear panel or one of the loopback signals (LL & RL). An LED overlay is used to associate each LED with a particular circuit. See Figure V36-24.

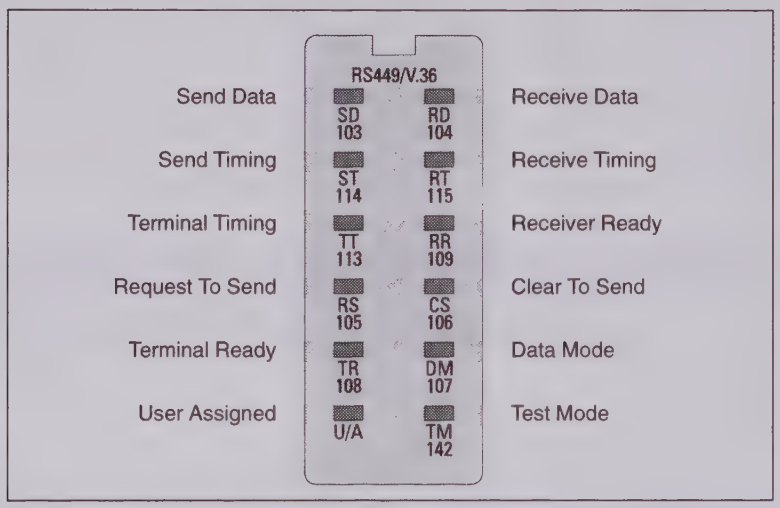


Figure V36-24 LED Overlay (with Labels)

Underneath each LED, there is a standard circuit abbreviation and CCITT interface circuit number (not pin number).

The status of the individual interface circuits is indicated by the color of their respective LEDs. If no signal is present, or if the signal floats between binary 1 and binary 0, the corresponding LED will be OFF. If a circuit is driven HIGH (binary 0), its LED will be RED. If a circuit is driven LOW (binary 1), its LED will be GREEN. If a circuit is rapidly alternating between binary 1 and binary 0, its LED will be ORANGE (steady or flickering). See Table 3.

LED Color	Pin Status
OFF	No Signal; or Floating
RED	High; Binary 0 (Space)
GREEN	Low; Binary 1 (Mark)
ORANGE	Alternating between High & Low

Table 3 Front Panel LED Color Indication

V36.7. Viewing Results in Run Mode

The RS-449/V.36 Line Interface software (LIP) offers two basic screens for displaying results in the Run Mode. These are the Network Status and Character Trace screens. Either of these screens may be displayed automatically upon entering the Run Mode by selecting it for the initial Run Mode display. This is described in the Initial Displays section of the "Applications" chapter in the *DA-30/31 Operating Manual.*

If higher-layer protocol packages are loaded and active in the current application, you can also access the Protocol Trace screens by pressing F3 (protocol traces) from the Run Mode Top Rack.

V36.7.1. Network Status Screen

To access the Network Status screen, press F1 (NETWORK STATUS) from the Run Mode Top Rack. The Network Status screen that appears when using synchronous data formats (BOP or SYNC) differs from the one that appears when using asynchronous data formats (ASYNC).

When Using BOP or SYNC:

The Network Status screen that appears when using the BOP or SYNC data format is shown in Figure V36-25.

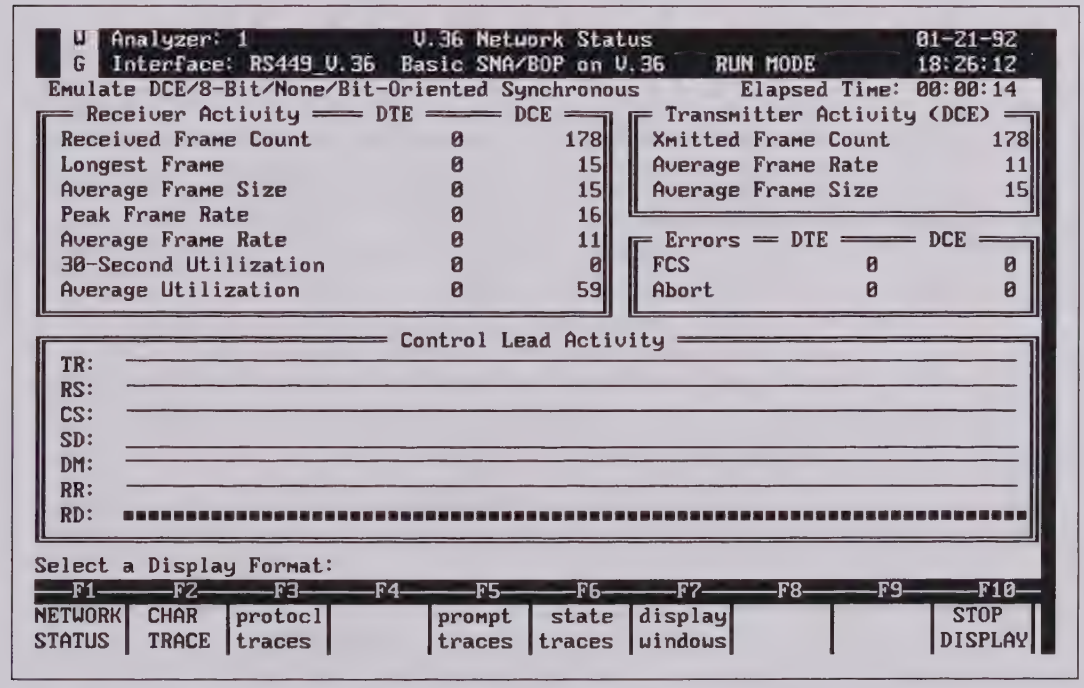


Figure V36-25 RUN MODE Network Status Screen (BOP or SYNC)

The first line of this screen summarizes the Line Setup settings. The current Test Mode, number of Bits per character, type of Parity used (if any), and the Format (transmission technique) used for the data are all listed as follows:

Test Mode/Bits/Parity/Format

The first line also contains an Elapsed Time counter that reports the time that elapsed since the current application started running. The rest of the screen is subdivided into four sections that detail the Receiver Activity, Transmitter Activity, Errors and Control Lead Activity.

V36.7.1.1. Receiver (or Playback) Activity

The name of this section depends on the Source selection on the Line Setup menu. If the data being analyzed comes from the Line, this section is labelled Receiver Activity. If the data comes from a logged data file, this section is labelled Playback Activity.

> **Note:**
>
> Because the log file structures for BOP, SYNC and ASYNC data formats are unique, only playback log files using the data format in which they were created. Otherwise, you may get unpredictable results.

This section is further partitioned into two columns. One for the DTE side of the interface and one for the DCE side. For each side of the interface, the following information is reported:

- Received Frame Count – the current number of frames received.
- Longest Frame – the size (in bytes) of the longest frame that has been received since receiving began.
- Average Frame Size – the current average size (in bytes) of the received frames since receiving began.
- Peak Frame Rate – the highest frame rate (Frames per second) detected at the receiver.
- Average Frame Rate – the current average frame rate (Frames per second).
- 30-Second Utilization – the average utilization (%) for the past 30-second interval. This field is updated every 30 seconds.
- Average Utilization – the average utilization (%) since receiving began.

> **Note:**
>
> Currently, the 30-Second Utilization and Average Utilization fields are supported only when the Clock Source is set to Internal. Otherwise, these fields will display "Unavail".

V36.7.1.2. Transmitter Activity ( )

Depending on the Test Mode, the area inside the parentheses, ( ), will contain one of the following designations:

MON. When MONITOR is the selected Test Mode.

DTE. When EMULATE is the selected Test Mode and DTE is the selected Side.

DCE. When EMULATE is the selected Test Mode and DCE is the selected Side.

Whether emulating a DTE or DCE, this section reports the following information:

- Transmitted Frame Count – the current number of frames that have been transmitted.
- Average Frame Rate – the current average rate (Frames per second) at which frames are being transmitted.
- Average Frame Size – the current average size (in bytes) of the transmitted frames since transmission began.

V36.7.1.3. Errors

This section is also partitioned into a DTE column and a DCE column. For each side of the interface, the following counters report the number of errors detected by the receiver:

- FCS – this counter is incremented each time a Frame Check Sequence (CRC) error occurs.
- Break – this counter is incremented each time a Break or Abort occurs. Depending on the data format being used, the counter value represents the number of Breaks or Aborts that have occurred. See Table 4.

Error Type	Data Format	Error Condition
Abort	BOP	Seven consecutive ones occurs in data stream.
Abort	SYNC	The specified Abort character appears in the data stream when the Block Check is calculated. -or- The receiver goes out of sync – due to the Outsync character being detected for the specified number (Outsync Count) of times.
Break	ASYNC	Consecutive zeros occurring for Start, Data, & optional Parity bits.

Table 4 Type of Errors Reported by the Break Counter

V36.7.1.4. Control Lead Activity

This section of the screen graphically displays the waveforms for the transmit data (SD), receive data (RD), and control leads (TR, RS, CS, DM and RR). This allows you to examine their timing relationships. These waveforms reflect the settings on the Control Lead Setup menu. A fill-in character (▮) is used to indicate data activity on the SD and RD lines. An underscore (_) represents inactivity.

This section of the screen is enabled only when YES is selected for Monitor Leads on the Line Setup menu. It is otherwise left blank. It is also blank whenever playing back data from a logged file.

When Using ASYNC:

When using asynchronous data formats, the Network Status screen appears as shown in Figure V36-26.

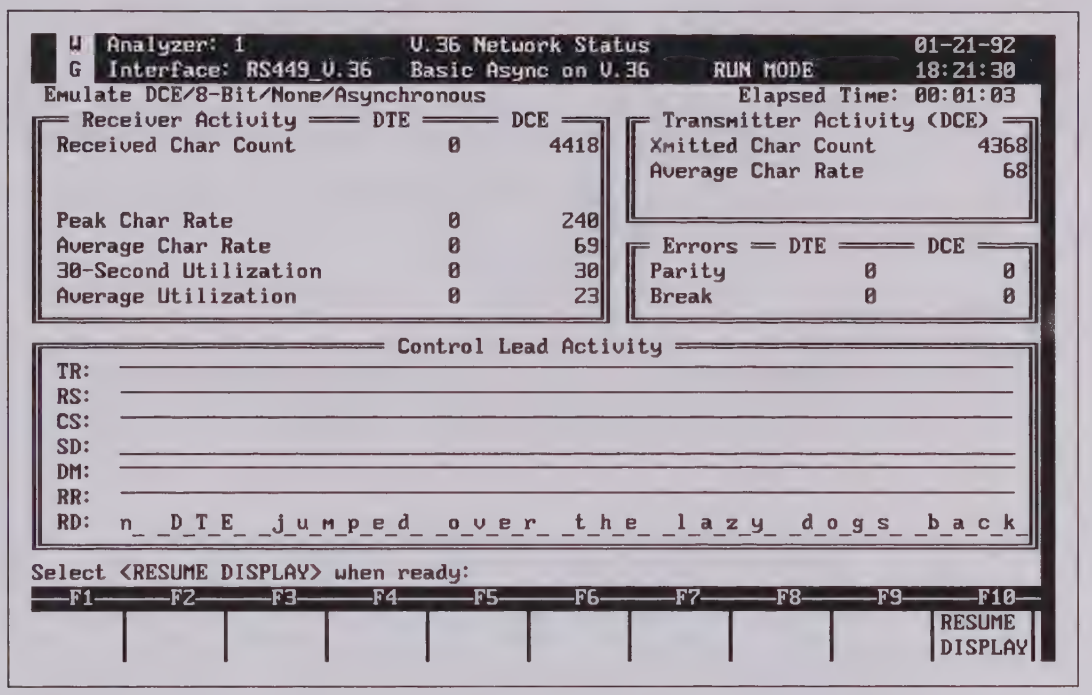


Figure V36-26 RUN MODE Network Status Screen (ASYNC)

Since the basic unit of asynchronous transmission is the character , the word “Frame” is replaced by “Char” in all of the fields in the Receiver Activity and Transmitter Activity sections of the screen. Moreover, those fields that have only to do with frames have been removed (i.e. Longest Frame, Average Frame Size).

Instead of using the fill-in character to represent data activity, in the Control Lead Activity section, the SD and RD lines show the actual characters being transmitted/received.

V36.7.2. Character Trace Screen

To access the Character Trace screen, press F2 (CHAR TRACE) from the Run Mode Top Rack. The Character Trace screen that appears when using synchronous data formats (BOP or SYNC) differs from the one that appears when using asynchronous data formats (ASYNC).

When Using BOP or SYNC:

The Character Trace screen that appears when using the BOP or SYNC format is shown in Figure V36-27.

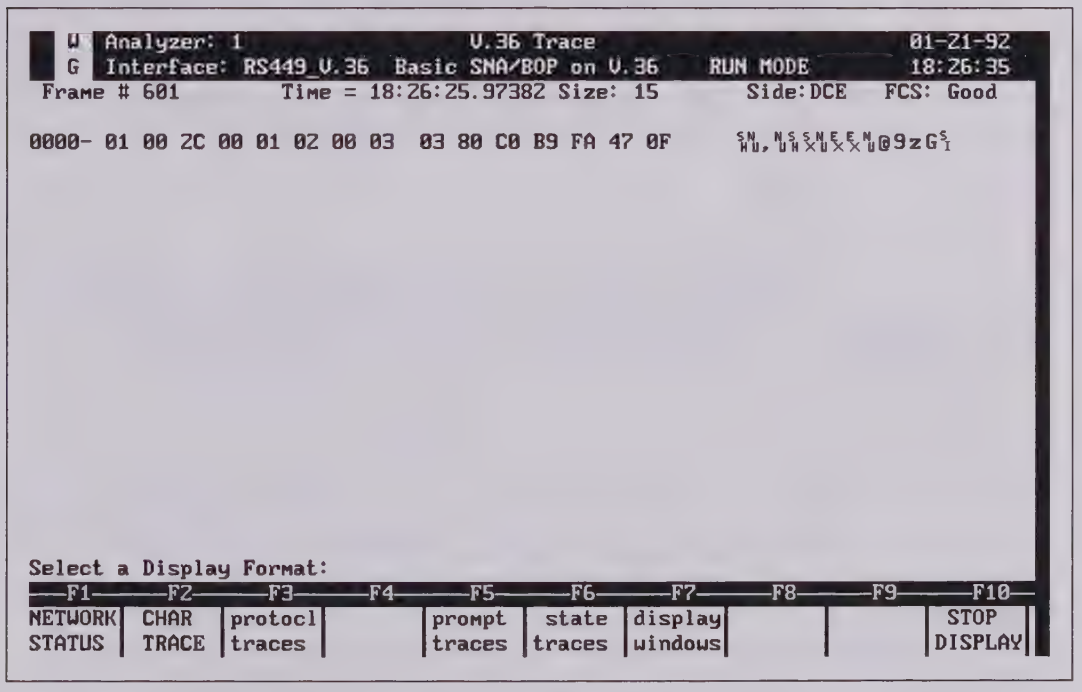

Analyzer: 1 V.36 Trace 01-21-92
Interface: RS449_V.36 Basic SNA/BOP on V.36 RUN MODE 18:26:35
Frame # 601 Time = 18:26:25.97382 Size: 15 Side:DCE FCS: Good
0000- 01 00 2C 00 01 02 00 03 03 80 C0 B9 FA 47 0F
Select a Display Format:
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
NETWORK STATUS
CHAR TRACE
protocl traces
prompt traces
state traces
display windows
STOP DISPLAY

Figure V36-27 RUN MODE Character Trace Screen (BOP or SYNC)

For each frame that is received, the first line of this screen shows the number of the frame, the time it was received, its size (in bytes), the side of the line that is being monitored, and the result of the FCS (CRC) evaluation. The rest of the screen displays the frame data in hexadecimal representation (on left) and in the character representation (on right). The character code used depends on the Character Code setting on the Display Setup menu – accessed via the analyzer window's Initial Display field.

When Using ASYNC:

The Character Trace screen that appears when using the ASYNC data format is shown in Figure V36-28.

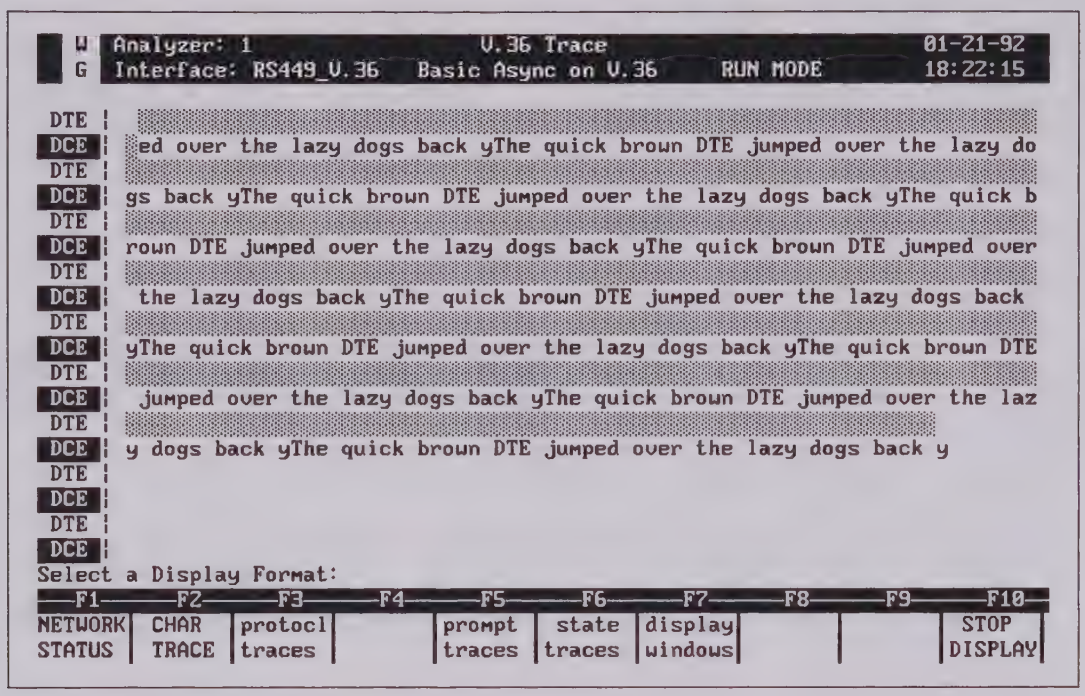

Analyzer: 1 V.36 Trace 01-21-92
Interface: RS449_V.36 Basic Async on V.36 RUN MODE 18:22:15
DTE
DCE
ed over the lazy dogs back yThe quick brown DTE jumped over the lazy do
gs back yThe quick brown DTE jumped over the lazy dogs back yThe quick b
roun DTE jumped over the lazy dogs back yThe quick brown DTE jumped over
the lazy dogs back yThe quick brown DTE jumped over the lazy dogs back
yThe quick brown DTE jumped over the lazy dogs back yThe quick brown DTE
jumped over the lazy dogs back yThe quick brown DTE jumped over the laz
y dogs back yThe quick brown DTE jumped over the lazy dogs back y
Select a Display Format:
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
NETWORK STATUS
CHAR TRACE
protocl traces
prompt traces
state traces
display windows
STOP DISPLAY

Figure V36-28 RUN MODE Character Trace Screen (ASYNC)

This screen displays character data in a Data Line Monitor format. Each line of the display alternates between the DTE and the DCE. Each line is appropriately labelled DTE or DCE. Moreover, the word DCE is highlighted to help distinguish DTE data from DCE data.

V36.8. Viewing Results in the Examine Mode

The RS-449/V.36 Line Interface software offers the same two basic screens for examining a capture file in the Examine Mode as those described in the Run mode. Either of these screens may be displayed automatically upon entering the Examine Mode by selecting it for the initial Examine Mode display. This is described in the Initial Displays section of the "Applications" chapter in the *DA-30/31 Operating Manual.*

> **Note:**
>
> Because the data framing for BOP, SYNC and ASYNC are unique, you should only Examine capture files using the data format in which they were created. Otherwise, you may get unpredictable results.

V36.8.1. Network Status Screen

To access the Network Status screen, press F1 (NETWORK STATUS) from the Examine Mode Top Rack. This screen is identical to the Run Mode Network Status screen for each of the data formats (BOP, SYNC and ASYNC).

V36.8.2. Character Trace Screen

The Character Trace screen that appears when using synchronous data formats (BOP or SYNC) differs from the one that appears when using asynchronous data formats (ASYNC).

When Using BOP or SYNC:

When using the BOP or SYNC data format, the Character Trace screen looks just like the one described in Run Mode. If there are higher-level protocol packages loaded and running, you can display their traces by pressing F3 (protocol traces) from the Exam Mode Top Rack. You can then selectively display frames based on multiple (core & protocol-specific) criteria by pressing F8 (display filters). You can also access the Frame Detail screen by pressing F9 (FRAME DETAIL) from the protocol traces softkey rack. The core find commands, as well as any other protocol-specific find commands, are available by pressing F10 (find command) from either the character or protocol trace softkey rack.

When Using ASYNC:

When using the ASYNC data format, the Character Trace that appears is shown in Figure V36-29.

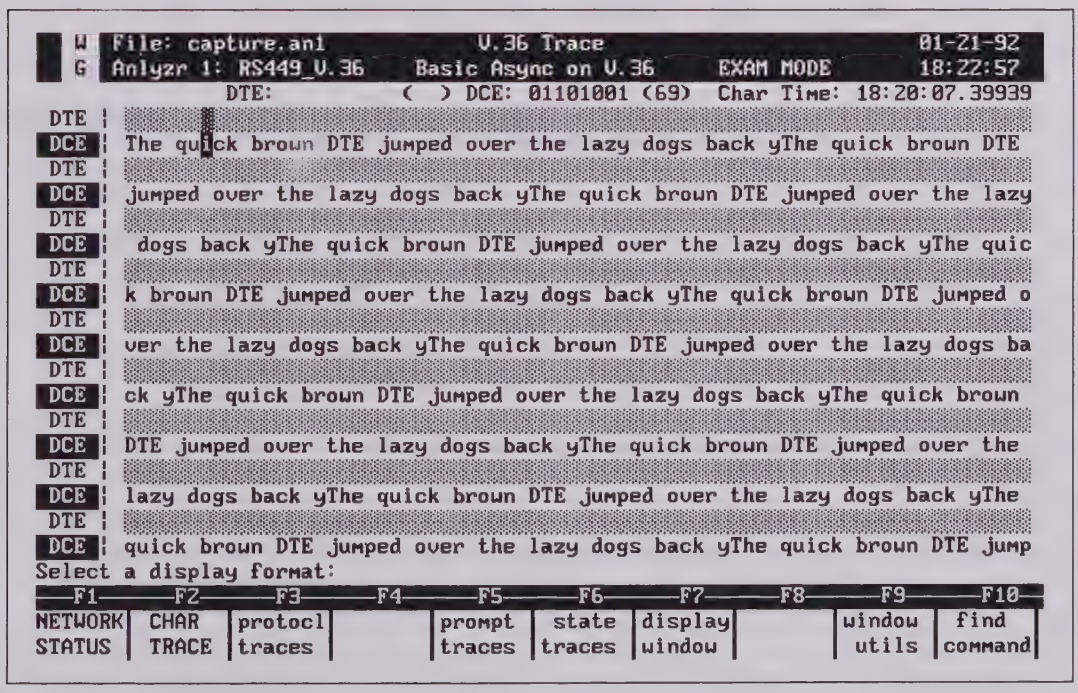

File: capture.anl V.36 Trace 01-21-92
Anlyzr 1: RS449_V.36 Basic Async on V.36 EXAM MODE 18:22:57
DTE: ( ) DCE: 01101001 (69) Char Time: 18:20:07.39939
DTE
DCE The quick brown DTE jumped over the lazy dogs back yThe quick brown DTE
DTE
DCE jumped over the lazy dogs back yThe quick brown DTE jumped over the lazy
DTE
DCE dogs back yThe quick brown DTE jumped over the lazy dogs back yThe quic
DTE
DCE k brown DTE jumped over the lazy dogs back yThe quick brown DTE jumped o
DTE
DCE ver the lazy dogs back yThe quick brown DTE jumped over the lazy dogs ba
DTE
DCE ck yThe quick brown DTE jumped over the lazy dogs back yThe quick brown
DTE
DCE DTE jumped over the lazy dogs back yThe quick brown DTE jumped over the
DTE
DCE lazy dogs back yThe quick brown DTE jumped over the lazy dogs back yThe
DTE
DCE quick brown DTE jumped over the lazy dogs back yThe quick brown DTE jump
Select a display format:
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
NETWORK STATUS
CHAR TRACE
protocl traces
prompt traces
state traces
display window
window utils
find command

Figure V36-29 EXAM MODE Character Trace Screen (ASYNC)

This screen is identical to the Character Trace described for the Run Mode except for the first line. Displayed on the first line of this screen is the binary and hexadecimal representations of the characters located at the cursor position. The cursor highlights two character time slots at a time – one for the DTE and one for the DCE.

> **Note:**
>
> The Character Trace for ASYNC is available only if the RS-449/V.36 LIP was loaded when the capture file was created.

No display filters or find commands (core or protocol-specific) are available for capture files created while using the ASYNC data format. Moreover, Frame Detail is not allowed. If the Frame Detail softkey is pressed, the error message shown in Figure V36-30 will be displayed.

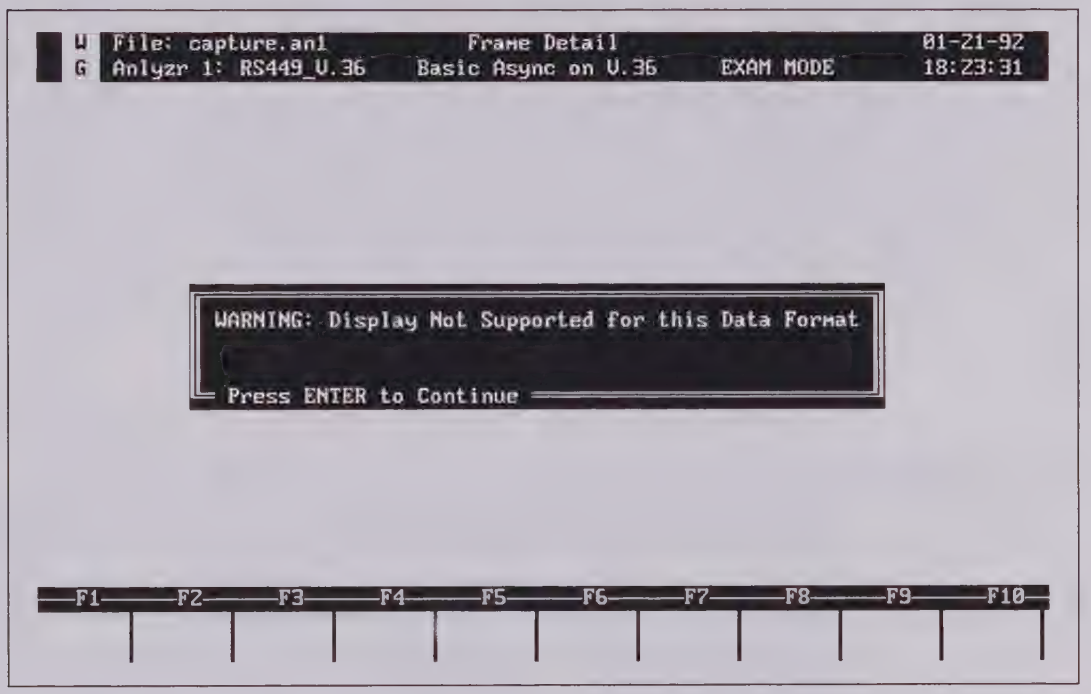

W File: capture.anl Frame Detail 01-21-92
G Anlyzr 1: RS449_V.36 Basic Async on V.36 EXAM MODE 18:23:31
WARNING: Display Not Supported for this Data Format
Press ENTER to Continue
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10

Figure V36-30 Warning: Frame Detail in ASYNC

Second Edition October 1993 Release 3.4 and after

HSV.36

High Speed V.36 Interface Operation:

(Addendum to the V.36 Interface Operation Document)

HSV36.1. Introduction

The High Speed V.36 Interface retains the basic functionality of the V.36 Interface. However, the High Speed V.36 Interface boasts several enhancements over its counterpart that are summed up as follows:

- **Increase in Operating Speed**
  The High Speed V.36 Interface operates over a range of 50 bps to 2.048 Mbps whereas the V.36 Interface operates at no more than 256 kbps.
- **Revised Setup Menus**
  The V.36 Interface setup menus have been revised and reorganized to produce those for the High Speed V.36 Interface. The revised menus are clearer and easier to understand. New fields have been added, and some existing fields have been given substantially new functionality.
- **New Network Status Screen**
  The High Speed V.36 Network Status screen contains all the original information on the V.36 Network Status screen. However, it provides additional status information and places less emphasis on the control leads.
- **Dropped Bisync and Async Data Framing**
  The High Speed V.36 Interface does not support character-oriented protocols (i.e. Bisync) or Asynchronous (Async) data framing. This interface supports only Bit-Oriented Protocols (BOPs).

In addition to the above-mentioned enhancements, this document describes the installation, external connections, and the software setup for the High Speed V.35 Interface.

HSV36.2. Installation

The actual Line Interface Module used for the High Speed V.35 Interface is identical to the one used for the V.35 Interface. The differences in their functionality stem from their corresponding feature modules, LIP software and LPP software.

> **Note:**
>
> Before you can use the High Speed V.36 Line Interface, you must also have a Protocol Analyzer Module and a High Speed WAN Feature Module installed.

HSV36.2.1. Loading the LIP & LPP Software

To load the LPP software:

(Substitute HS_V.36 for RS-449/V.36.)

To load the LIP software:

(Substitute HS_V.36 for RS-449/V.36.)

HSV36.2.1.1. Auxiliary I/O Pins

The status of these auxiliary pins (one at a time) can be displayed by the front-panel LED that is labelled U/A (User Assigned).

> **Note:**
>
> The PAL Keywords that monitor and control AUX 1 and AUX 2 will be available in a later release.

HSV36.3. Setting Up The Line Interface

By now, you have installed the LIM in the DA-30, installed and loaded the LIP and LPP software, and made the appropriate test connections for monitoring or emulation. You are now ready to setup the line interface for your particular test. To perform the setup, press F2 (line setup) to see the top level setup screen HS_V.36 Setup shown in Figure HSV36-1. You may select either of the following two setup menus:

- Line Setup
- Control Lead Setup

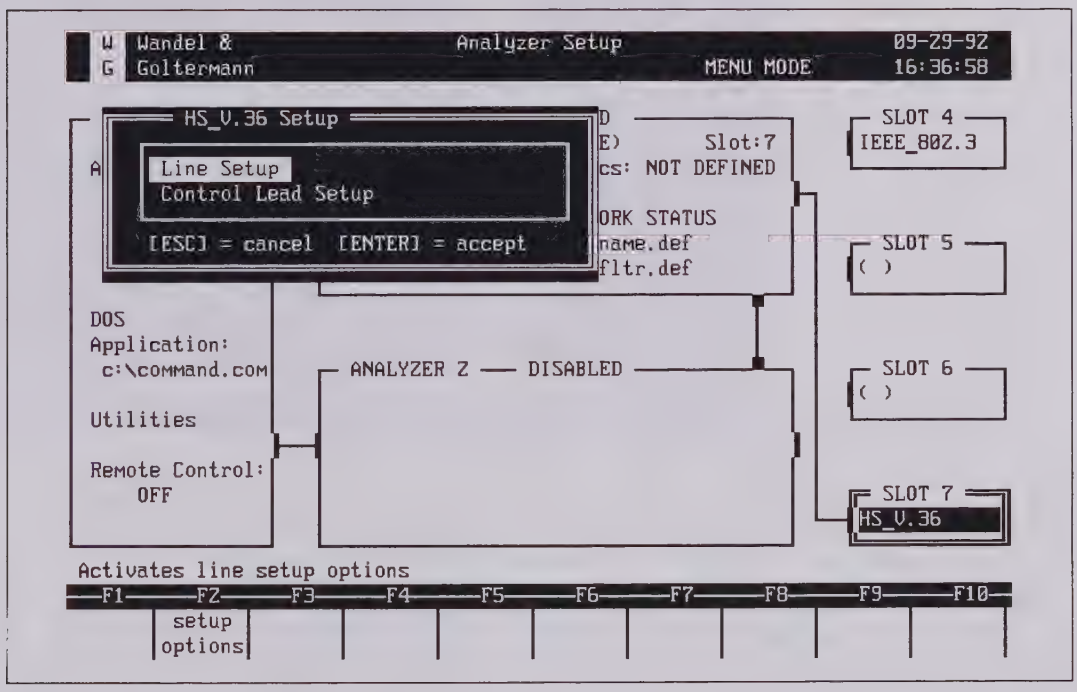


Figure HSV36-1 HS_V.36 Setup Screen

HSV36.3.1. The Line Setup

The cursor should already be on Line Setup. Press F2 (setup options) to see the Line Setup menu shown in Figure HSV36-2.

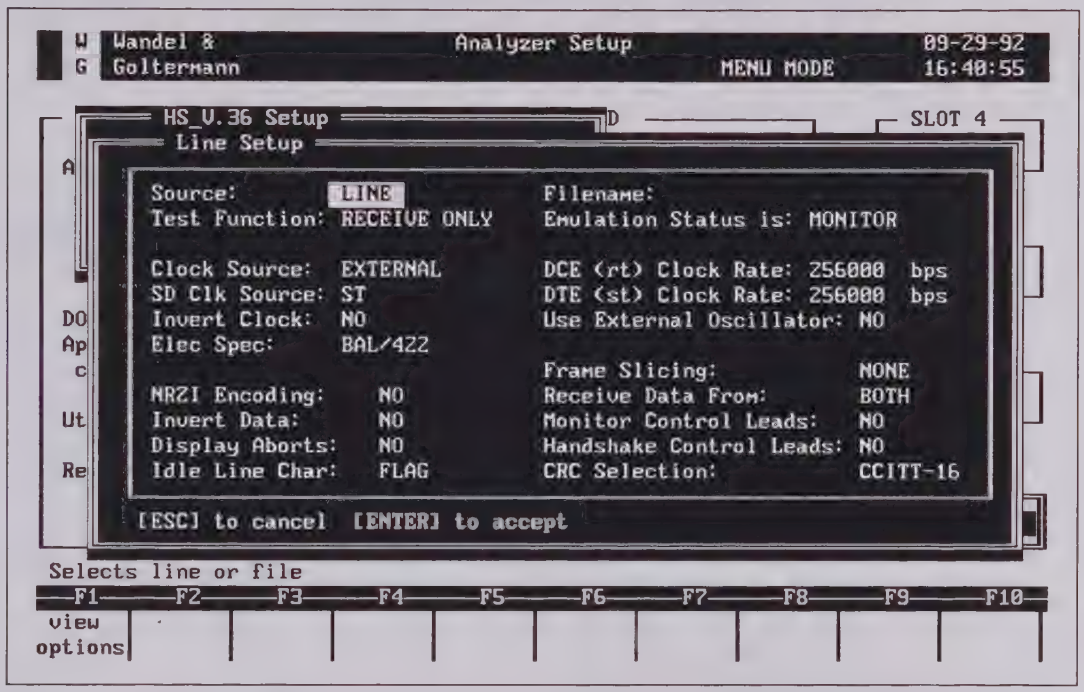


Figure HSV36-2 Line Setup

The Line Setup menu allows you to configure the data line parameters.

HSV36.3.1.1. Test Function

This field allows you to select between three modes of operation:

- RECEIVE ONLY – the DA-30 passively monitors network activity on both sides of the DTE-DCE interface. An uninterrupted signal path is provided between the rear panel DCE and DTE connectors. For example, pin 1 of the DCE connector is internally connected to pin 1 of the DTE connector. Received data is also processed according to the Network Event Program (if defined).
- EMULATE DCE – the DA-30 emulates a DCE device while appropriately driving the CS, RR, DM, ST, and RT leads. This selection is used when testing DTE equipment (i.e. computer, terminal, etc.). Received data is also processed according to the Network Event Program (if defined).
- EMULATE DTE – the DA-30 emulates a DTE device while appropriately driving the RS, TR, and TT leads. This selection is used when testing DCE equipment (i.e. modem). Received data is also processed according to the Network Event Program (if defined).

HSV36.3.1.2. Clock Source

This field allows you to select the source of the clocks that the DA-30 provides to the interface. Your selections, here, are valid only in the Emulate DCE and Emulate DTE modes (Table 1).

When **Test Function** is set to:	**Clock Source** determines the source of:
Receive Only	No meaning
Emulate DCE	ST & RT clocks
Emulate DTE	TT clock

Table 1 Test Function vs Clock Source Control

There are three choices:

- EXTERNAL – This setting is used when the DA-30 acts as a monitor between a DTE and a DCE—with the DA-30 clock being supplied by the DTE, DCE, or some other source. "External" means that the source of the clocks provided by the DA-30 is one of the clock leads on the V.36 interface.

  This setting can also be used when emulating a DTE or DCE. If emulating a DTE, the transmit and receive clocks (ST & RT) would typically be provided by the DCE. If emulating a DCE, the transmit and receive clocks (ST & RT) are derived from an externally supplied transmit clock (TT). Be sure to set Xmit Clock to SCTE.

- INTERNAL – This setting is used when the DA-30 is emulating a DTE or DCE. "Internal" means that the source of the clocks provided by the DA-30 is either the External Oscillator input or one of the crystal oscillators located on the High Speed WAN Feature Module.

  If emulating a DTE, the DA-30 would provide the timing for the interface using the TT clock lead. The DCE uses TT to derive the transmit and receive clocks (ST & RT). If emulating a DCE, the DA-30 would provide the transmit and receive clocks (ST & RT) for the interface.

- SPLIT – This setting is used when the DA-30 is emulating a DCE in a system where different baud rates are used for receive and transmit data (ST & RT clocked at different rates). One baud rate generator is used to generate a clock frequency as close as possible to the rate entered in the DCE Clock Rate field and transmit it on the RT lead. Another baud rate generator is used to generate a clock frequency as close as possible to the rate entered in the DTE Clock Rate field and transmit it on the ST lead. When selecting SPLIT as the Clock Source, you must select a DCE Clock Source in the SD Clk Source field.

Note:

The default selection for this field is automatically made based on your Test Function selection. You may override this default selection at any time.

HSV36.3.1.3. SD Clk Source

This field allows you to specify the clock that provides the timing for Send Data (SD). The choices are:

- ST — The Send Timing clock is used as the timing reference for data transmitted on SD.
- RT — The Receive Timing clock is used as the timing reference for data transmitted on SD.
- TT — The Terminal Timing clock is used as the timing reference for data transmitted on SD.

HSV36.3.1.4. Invert Clock

This field allows you to invert the polarity of the clocks. The choices are:

- NO — The ST, RT, and TT clocks are left unchanged. The DA-30 receives data on the "On-to-Off" transition of the receive clock (RT) and transmits data on the "Off-to-On" transition of the transmit clocks (ST & TT).
- YES — Inverts the ST, RT, and TT clocks. This means that the DA-30 receives data on the "Off-to-On" transition of RT (rather than the "On-to-Off" transition) and transmits data on the "On-to-Off" transition of ST and TT.

HSV36.3.1.5. Invert Data

This field enables the interface to meet MIL-188C signalling requirements by inverting the polarity of the data being transmitted on both SD and RD. The choices are:

- NO — The polarity of the data is left unchanged.
- YES — Inverts the polarity of the data.

This field defaults to NO.

HSV36.3.1.6. Display Aborts

This field allows you to select whether or not Aborted frames trigger a specific event in the Network Event Program.

- NO
- YES

This field defaults to NO.

HSV36.3.1.7. Idle Line Char

This field allows you to select the character that the receiver interprets as an idle line (no data being transmitted).

- FLAG — Sets the Idle Line Character to 7E (hex).
- MARK — Sets the Idle Line Character to FF (hex).

The default Idle Line Character is FLAG (7E).

HSV36.3.1.8. Filename

When the Source is set to FILE, you enter the name of the logged data file here. To see a list of available filenames to choose from, press F1 (view options). Use the cursor keys to highlight a filename and press Enter to load the file.

HSV36.3.1.9. Emulation Status

This field reports whether the DA-30 is currently monitoring or emulating depending on your Test Function selection (Table 2).

Test Function	Emulation Status
RECEIVE ONLY	MONITOR
EMULATE DCE	EMULATE
EMULATE DTE	EMULATE

Table 2 Emulation Status Field

This is a status field only and cannot be directly modified using the cursor.

HSV36.3.1.10. DCE (scr) Clock Rate

When emulating a DCE, this field is used to set the desired clock rate (in bits/sec) for RT and/or ST.

- If Clock Source is set to INTERNAL, this field is used to set the frequency of both the RT & ST clocks (Figure HSV36-3).

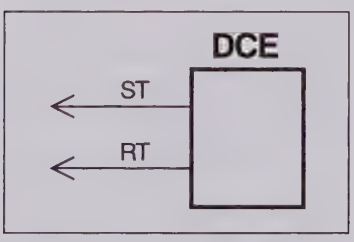


Figure HSV36-3 Setting the Clock Rate When Clock Source Is Set To INTERNAL

- If Clock Source is set to SPLIT, this field is used to set the frequency of the RT clock only (Figure HSV36-4).

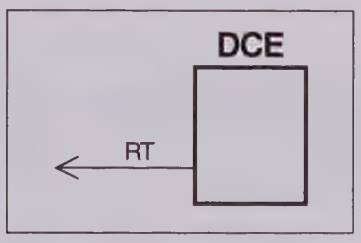


Figure HSV36-4 Setting the Clock Rate When Clock Source Is Set To SPLIT

The DA-30 will generate a frequency as close as possible to the entered value. This field defaults to 256000 bps.

HSV36.3.1.11. DTE (sct) Clock Rate

This field is used to set the desired clock rate (in bits/sec) for ST or TT.

- If Clock Source is set to SPLIT and Test Function is set to EMULATE DCE, this field is used to set the frequency of the ST clock (Figure HSV36-5).

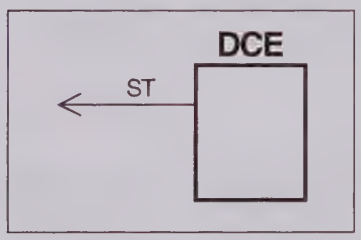


Figure HSV36-5 Setting the Clock Rate When Clock Source Is Set To SPLIT

- If Clock Source is set to EXTERNAL and Test Function is set to EMULATE DTE, this field is used to set the frequency of the TT clock (Figure HSV36-6). This field defaults to 256000 bps.

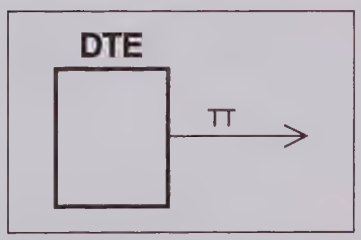


Figure HSV36-6 Setting the Clock Rate When Clock Source Is Set To EXTERNAL

HSV36.3.1.12. Use External Oscillator

This field determines how the transmit and receive clocks are generated—internally or externally. The choices are:

- YES – The transmit and receive clocks are derived from a clock signal at the External Oscillator input (BNC) on the rear panel of the High Speed WAN Feature Module. The crystal oscillators on the High Speed WAN Feature Module are disabled. The frequency at the External Oscillator input will be calculated upon entering the Run Mode.
- NO – The transmit and receive clocks are derived from the crystal oscillators on the High Speed WAN Feature Module. The External Oscillator input is disabled.

HSV36.3.1.13. Frame Slicing

Frame slicing is not valid when using the ASYNC data format.

HSV36.3.1.14. Receive Data From

The received data that is processed by the analyzer can come from either or both sides of the interface. This field allows you to make that selection. The choices are:

- BOTH – Signals from both the DTE and the DCE sides of the interface are passed to the analyzer for processing.
- DTE – Only signals from the DTE side of the interface are passed up to the analyzer for processing.
- DCE – Only signals from the DCE side of the interface are passed up to the analyzer for processing.

This field defaults to BOTH.

HSV36.3.1.15. Monitor Control Leads

This field allows you to monitor the activity of the data and control leads (SD, RD, RS, CS, RR, TR, and DM). The choices are:

- NO – The data and control leads are not monitored.
- YES – The data and control leads are monitored. Their activity is displayed in the Control Lead Activity section of the Network Status screen. This selection allows you to program the interface using the control lead condition keywords. These keywords are described in the "High Speed V.35 PAL Reference" section of the *DA-30/31 Line Interface Programming* binder. This binder is part of the *DA-30/31 Programming Documentation Set* which is sold separately.

Note:

Selections in this field are valid only when Source is set to LINE.

This field defaults to NO.

HSV36.3.1.16. Handshake Control Leads

This field allows you to select whether or not control lead handshaking is performed when emulating (DCE or DTE). The control leads must be set to ON or SWITCH in the Control Lead Setup menu. The choices are:

- NO – No control lead handshaking is performed during data transmission.
- YES – Control lead handshaking is performed based on the settings on the Control Lead Setup menu and the Test Function setting (EMULATE DTE or EMULATE DCE). A warning is displayed if there is an invalid control lead setting.

This field defaults to NO.

> **Note:**
>
> Enabling control lead handshaking may degrade overall performance by an unspecified amount.

HSV36.3.1.17. CRC Selection

This field allows you to select the frame check sequence (CRC) polynomial that is used. The choices are:

- CCITT-16 – Selects the following 16-bit CCITT polynomial:

  $(x^{16} + x^{15} + x^{2} + 1)$

- CRC-32 – Selects the following 32-bit Ethernet polynomial:

  $(x^{32} + x^{26} + x^{23} + x^{22} + x^{16} + x^{12} + x^{11} + x^{10} + x^{8} + x^{7} + x^{5} + x^{4} + x^{2} + x^{1})$

- NONE – All CRC checking is disabled. No CRC is generated for transmitted frames, and all received frames are assumed to have good CRCs.

HSV36.3.2. Control Lead Setup

Move the cursor to Control Lead Setup and press F2 (lead options) to see the Control Lead Setup menu shown in Figure HSV36-7.

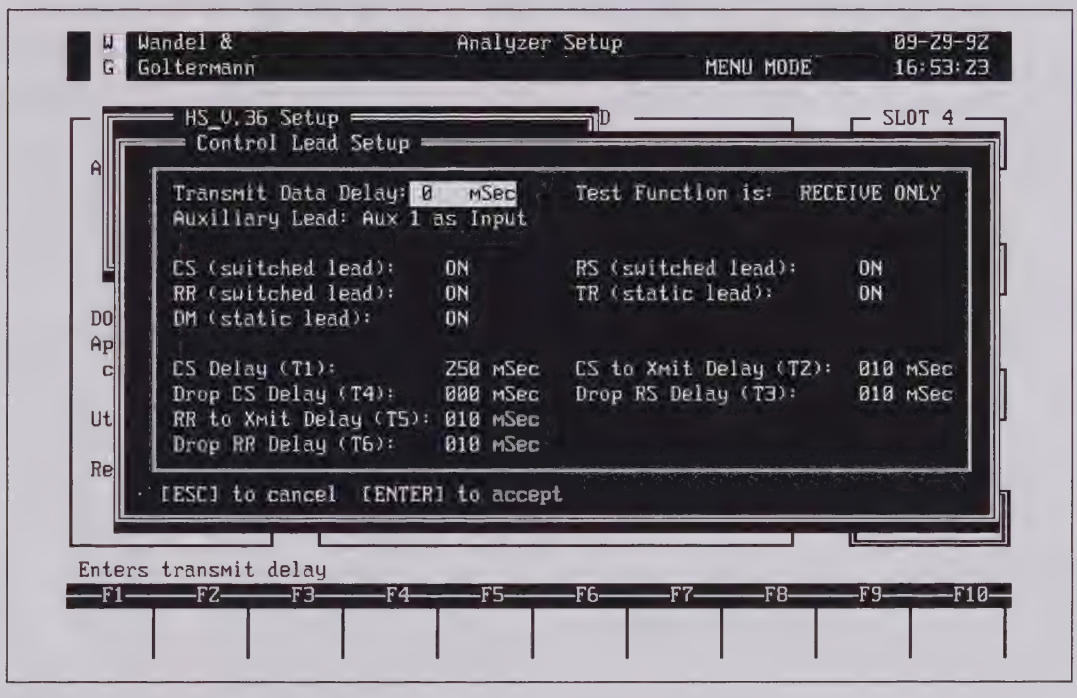

W Wandel &
G Goltermann
Analyzer Setup
MENU MODE
09-Z9-9Z
16:53:Z3
HS_V.36 Setup
Control Lead Setup
SLOT 4
Transmit Data Delay: 0 mSec
Test Function is: RECEIVE ONLY
Auxiliary Lead: Aux 1 as Input
CS (switched lead): ON
RS (switched lead): ON
RR (switched lead): ON
TR (static lead): ON
DM (static lead): ON
CS Delay (T1): Z50 mSec
CS to Xmit Delay (T2): 010 mSec
Drop CS Delay (T4): 000 mSec
Drop RS Delay (T3): 010 mSec
RR to Xmit Delay (T5): 010 mSec
Drop RR Delay (T6): 010 mSec
[ESC] to cancel [ENTER] to accept
Enters transmit delay
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10

Figure HSV36-7 Control Lead Setup

This menu allows you to setup the initial state of the control leads as well as set the timing relationships between them. Your settings here are used only when the Test Function is set to EMULATE DCE or EMULATE DTE.

HSV36.3.2.1. Transmit Data Delay

This field allows you to set the delay (in milliseconds) between the time the DA-30 becomes ready to transmit (generate or playback) and the time it indicates its readiness to transmit (by raising the appropriate control lead). See Figure HSV36-16.

- When emulating a DTE, the RS lead is driven HIGH after the specified delay.
- When emulating a DCE, the RR lead is driven HIGH after the specified delay.

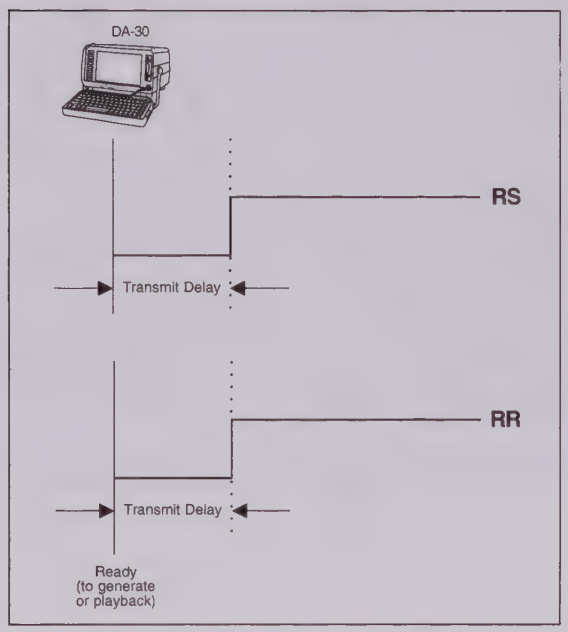


Figure HSV35-8 Transmit Delay

The delay can range from 0 to 999 milliseconds and defaults to 0 mSec.

HSV36.3.2.2. Auxiliary Lead

This field allows you to drive/monitor one of the auxiliary leads on the rear panel of the LIM. You may select auxiliary lead 1 (AUX 1) or 2 (AUX 2) and its function (input or output). The selected auxiliary lead status is displayed by the front-panel LED labelled U/A.

The choices are:

- Aux 1 as Input – The AUX 1 lead is configured as an input.
- Aux 1 as Output Off – The AUX 1 lead is configured as an output and driven to the Off state.
- Aux 1 as Output On – The AUX 1 lead is configured as an output and driven to the On state.
- Aux 2 as Input – The AUX 2 lead is configured as an input.
- Aux 2 as Output Off – The AUX 2 lead is configured as an output and driven to the Off state.
- Aux 2 as Output On – The AUX 2 lead is configured as an output and driven to the On state.

> **Note:**
>
> The "Aux 1 as Input" and "Aux2 as Input" selections are scheduled for future implementation.

HSV36.3.2.3. Test Function is

This is a status field that reports the Test Function setting (from the Line Setup menu) for your convenience.

HSV36.3.2.4. CS (switched lead)

This field allows you to select how the CS (Clear To Send) control lead behaves during Run Mode. The CS lead can be controlled only when emulating a DCE.

- OFF – The lead is driven LOW. If emulating a DTE, the DA-30 will transmit (on SD)—ignoring the CS OFF condition.
- ON – The lead is driven HIGH. If emulating a DTE, the DA-30 will transmit (on SD) without waiting for CS ON.
- SWITCH – The lead is turned ON and OFF under the control of the LIP. The initial state is OFF. If emulating a DTE, the DA-30 will wait for CS ON before transmitting (on SD).

  You may specify a delay that the DA-30 waits before turning CS ON after detecting RS ON. See the CS Delay (T1) field.

  You may also specify a delay that the DA-30 waits before turning CS OFF after detecting RS OFF. See the Drop CS Delay (T4) field.

This field defaults to ON.

HSV36.3.2.5. RR (switched lead)

This field defaults to ON.

HSV36.3.2.6. RS (switched lead)

This field defaults to ON.

HSV36.3.2.7. CS to Xmit Delay (T2)

This field allows you to set the amount of time (in milliseconds) that the DA-30 will wait before transmitting (on SD) after detecting CS ON. This field applies only when emulating a DTE.

The delay can range from 0 to 999 milliseconds and defaults to 10 mSec.

HSV36.3.2.8. Drop RS Delay (T3)

This field allows you to set the amount of time (in milliseconds) that the DA-30 will wait before turning RS OFF after it has stopped transmitting. This field applies only when emulating a DTE.

The delay can range from 0 to 999 milliseconds and defaults to 10 mSec.

Note About Switched Leads:

In general, when a switched lead is set to ON or OFF, the DA-30 will do so without respect to V.36 handshaking rules. However, when a switched lead is set to SWITCH and Handshake Control Leads is set to YES, normal handshaking rules will be observed. Thus, for proper operation, it is important that you make sure the device under test provides those handshaking signals that the DA-30 expects from the other side of the interface. The expected handshaking signals will, of course, depend on the emulation (DTE or DCE).

Table 3 summarizes the behavior of the control leads depending on their setting and the Test Function of the DA-30.

LEAD	SETTING	MEANING
Test Function = Emulate DTE		
RS	OFF	Turns RS OFF upon entering RUN Mode.
	ON	Turns RS ON upon entering RUN Mode.
	SWITCH	Turns RS ON before each transmission (SD). Turns RS OFF after each transmission.
CS	OFF	Turns CS OFF upon entering RUN Mode. Transmits without respect to CS OFF.
	ON	Turns CS ON upon entering RUN Mode. Transmits without respect to CS ON.
	SWITCH	Waits for CS ON before each transmission.
RR	OFF	Turns RR OFF upon entering RUN Mode. Raises RS for new transmission without respect to CS OFF.
	ON	Turns RR ON upon entering RUN Mode. Raises RS for new transmission without respect to CS OFF.
	SWITCH	Waits for CS OFF before raising RS for new transmission.
Test Function = Emulate DCE		
RS	OFF	Turns RS OFF upon entering RUN Mode. Raises RR to transmit (RD) without waiting for CS OFF.
	ON	Turns RS ON upon entering RUN Mode. Raises RR to transmit (RD) without waiting for CS OFF.
	SWITCH	Waits for CS OFF before raising RR to transmit (if CS & RR are switched).
CS	OFF	Turns CS OFF upon entering RUN Mode.
	ON	Turns CS ON upon entering RUN Mode.
	SWITCH	Turns CS ON after RS ON.
RR	OFF	Turns RR OFF upon entering RUN Mode.
	ON	Turns RR ON upon entering RUN Mode.
	SWITCH	Turns RR ON before each transmission. Turns RR OFF after each transmission.

Table 3 Control Lead Selection Summary

Table 4 shows some standard switched-lead settings for full-duplex and half-duplex systems.

CONFIGURATION	RS	CS	RR	EMULATION
Full-Duplex	ON	ON	ON	DTE
Half-Duplex	SWITCH	SWITCH	SWITCH	
Multi-point/Primary	ON	ON	SWITCH	
Multi-point/Secondary	SWITCH	SWITCH	ON	
Full-Duplex	ON	ON	ON	DCE
Half-Duplex	SWITCH	SWITCH	SWITCH	
Multi-point/Primary	ON	ON	SWITCH	
Multi-point/Secondary	SWITCH	SWITCH	ON	

Table 4 Standard Switched-Lead Settings

HSV36.4. TESTPREP Consistency Check

After you have the completed the interface setup (Line Setup and Control Lead Setup) and returned to the Main menu, you can run your current application by going to the Run Mode (press the Alt-Run keys). Before going from the Menu Mode to the Run Mode, the DA-30 runs a program called TESTPREP that checks to see if all your setup entries are consistent before compiling and running your application. If you have inadvertently created an inconsistent setup, TESTPREP flags the problem. A warning message will appear offering you the option of returning to Menu Mode to correct the inconsistent settings or allowing the DA-30 to change them for you. See Figure HSV36-17. If you choose the latter, the change takes effect in Run Mode only; that is, the menu selection is not physically altered. Running the application again without making the necessary correction(s) in the setup menus produces the same results. Therefore, upon seeing the warning message, you may wish to return to Menu Mode, correct the inconsistency, and save the application before running again.

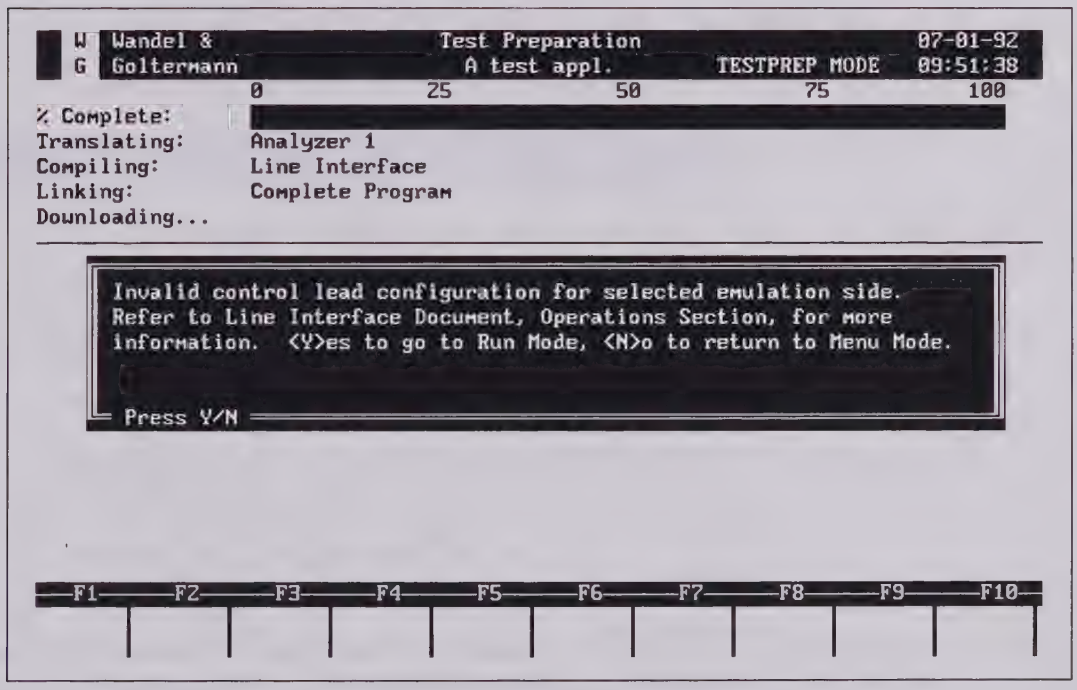


Figure HSV36-9 TESTPREP Warning

Note:

Recompilation does not always occur upon entering the Run Mode. Your application will be recompiled whenever either of the following Line Setup settings are modified:

- Source
- Handshake Control Leads

HSV36.5. Viewing Results in Run Mode

> **Note:**
>
> For maximum performance and speed, only load lower layer protocols in the protocol stack. However, when you want to view higher layer protocols, note that there may be a slight degradation in performance.

HSV36.5.1. Network Status Screen, Run Mode

The Run Mode Network Status screen for the High Speed V.36 Interface has been revised. It contains all the information on the V.36 screen—with some additional information (Figure HSV36-10). However, less emphasis is placed on the control leads.

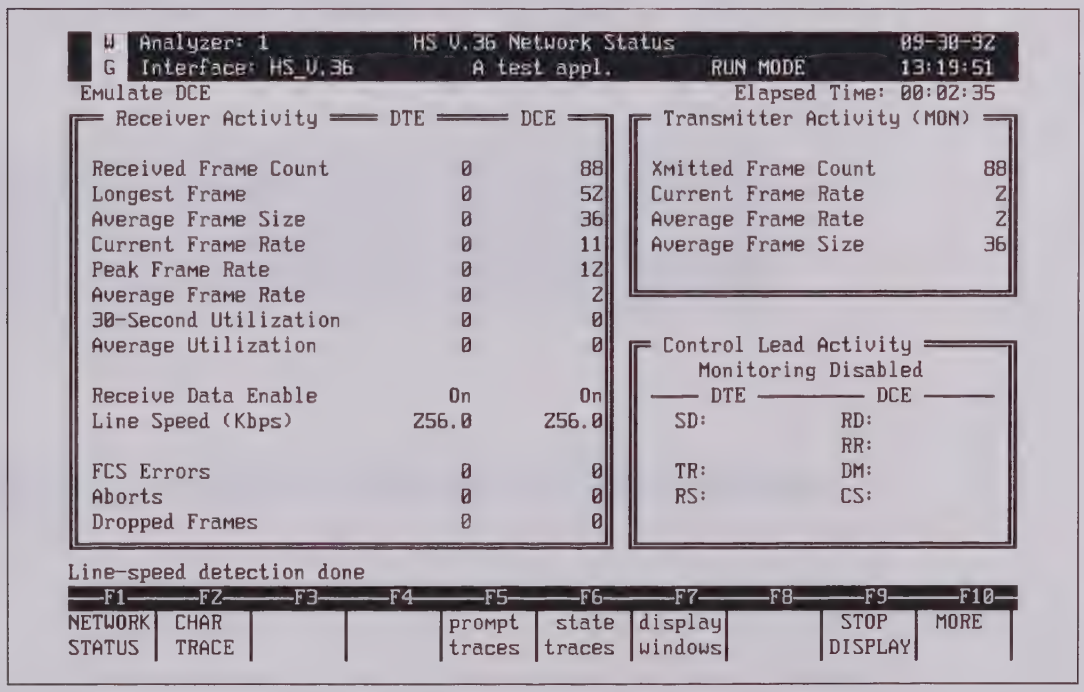


Figure HSV35-10 RUN Mode Network Status Screen

To access the Network Status screen, press F1 (NETWORK STATUS) from the Run Mode Top Rack.

The first line of this screen displays the current Test Function setting as well as an Elapsed Time counter that reports the time that elapsed since the current application started running.

The rest of the screen is subdivided into three sections that detail the Receiver Activity, Transmitter Activity, and Control Lead Activity.

HSV36.5.1.1. Receiver Activity

- Received Frame Count—the current number of frames received and processed.

  The **total** number of frames received at the line interface is equal to the sum of this count value and the Dropped Frames value (described later).

> **Note:**
>
> The maximum receive frame size is 3928 bytes.

- Peak Frame Rate—the highest frame rate (Frames per second) detected at the receiver since receiving began.
- 30-Second Utilization—the average utilization (%) for the past 30-second interval. This field is a "sliding-window" that is updated every second. During the first 30 seconds after entering Run Mode, this value is the average utilization for that period. Accuracy is 100 ppm.
- Average Utilization—the average utilization (%) since receiving began.

> **Note:**
>
> The 30-Second Utilization and Average Utilization fields are supported when Test Function is set to:
>
> - Emulate DCE
> - Emulate DTE or Receive Only (if a clock is detected on ST & RT upon entering Run Mode).
>
> Otherwise, these fields will display "Unavail".

- Receive Data Enable—This field tells which side of the interface (DTE and/or DCE) is enabled for receiving. This field gets its information from the Receive Data From setting on the Line Setup menu (Table 5).

Receive Data From Setting	**Receive Data Enable** Status	
	DTE	**DCE**
BOTH	On	On
DCE	Off	On
DTE	On	Off

Table 5 Receive Data Enable Status Indicators

- Line Speed (Kbps)—On entering the Run Mode, the line speed is determined if possible. Once determined, this value is displayed here. The line speed value is also used to calculate the Average and 30-Second Utilization values.

If, for some reason, it is not possible to determine the line speed (i.e. DA-30 not connected to the line in the RECEIVE ONLY or EMULATE DTE mode), the Line Speed is displayed as 0 and the utilization fields are displayed as unavailable ("Unavail").

- FCS Errors—this counter is incremented each time a Frame Check Sequence (CRC) error occurs.
- Aborts—this counter is incremented each time an Abort occurs. An Abort is defined to be the reception of seven (7) consecutive one (1) bits.
- Dropped Frames—This field provides a count of the number of frames that the Line Interface was able to receive, but the DA-30 itself could not accept for processing. The frames are "dropped," or thrown away, after being received.

> **Note:**
>
> These frames are not included in any other statistic.

The **total** number of frames received at the line interface is equal to the sum of this value and the Received Frame Count value (described earlier).

HSV36.5.1.2. Transmitter Activity

This section of the Network Status screen displays transmitter information. Depending on the Test Function, the area inside the parentheses, ( ), will contain one of the following designations:

MON. When RECEIVER ONLY is the selected Test Function.

DTE. When EMULATE DTE is the selected Test Function.

DCE. When EMULATE DCE is the selected Test Function.

Whether emulating a DTE or DCE, this section reports the following information:

- Xmitted Frame Count—the current number of frames that have been transmitted.
- Current Frame Rate—the current rate at which the DA-30 is transmitting frames.
- Average Frame Rate—the current average rate (Frames per second) at which frames are being transmitted.
- Average Frame Size—the current average size (in bytes) of the transmitted frames since transmission began.

HSV36.5.1.3. Control Lead Activity

This section of the Network Status screen displays control and data lead information when receiving data from the line. The control and data lead fields are grouped by line-side emulation. Each control lead field displays an approximate representation of the corresponding control lead status. The state of the control leads is indicated as shown in Table 6.

Status	Meaning
On / nc	The control lead carries a positive voltage or is not connected (or connected to a "dead" line).
Off	The control lead carries a negative voltage.

Table 6 Control Lead Status Indicators

The data leads (SD and RD) are monitored via software. The LIM has no direct method of determining the data lead status. The state of the data leads is indicated as shown in Table 7.

Status	Meaning
Data	A frame was received during the data lead sample interval.
Idle	A frame was not received during the data lead sample interval.

Table 7 Data Lead Status Indicators

As with the V.36 Interface, the High Speed V.36 Interface control lead activity is NOT correlated with the received frames. This means that the control lead activity is a frame-independent "snap shot" of the control leads at a given instant in time.

Note:

A majority of control lead events will be missed—especially at high bit rates.

This section of the screen is enabled only when Monitor Control Leads is set to YES on the Line Setup menu. When Monitor Control Leads is set to NO, the control lead fields are left blank, and "Monitoring Disabled" is displayed. The control lead fields are also left blank whenever playing back data from a logged file (i.e Source is set to FILE).

The last line of the Network Status screen reports the status of the line speed calculation (at the receiver). When the calculation is being performed, the following message is reported:

```
"Determining Line Speed"
```

After the calculation has been performed, the following message is reported:

```
"Line-speed detection done"
```

HSV36.5.2. Character Trace Screen, Run Mode

The Run Mode Character Trace screen looks just like the one described for the V.35 Interface. To access the Character Trace screen, press F2 (CHAR TRACE) from the Run Mode Top Rack. The Character Trace screen that appears is shown in Figure HSV36-11.

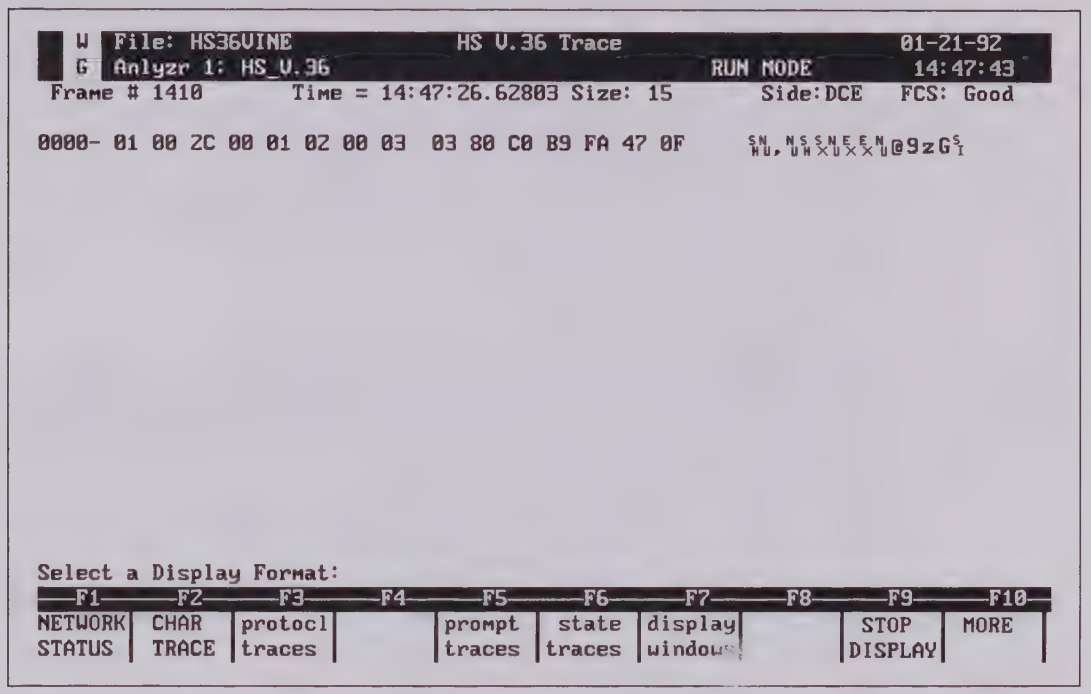

W File: HS36VINE HS V.36 Trace 01-21-92
G Anlyzr 1: HS_V.36 RUN MODE 14:47:43
Frame # 1410 Time = 14:47:26.62803 Size: 15 Side:DCE FCS: Good
0000- 01 00 2C 00 01 02 00 03 03 80 C0 B9 FA 47 0F
Select a Display Format:
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
NETWORK STATUS
CHAR TRACE
protocl traces
prompt traces
state traces
display windows
STOP DISPLAY
MORE

Figure HSV35-11 RUN Mode Character Trace Screen

For each frame that is received, the first line of this screen shows the number of the frame, the time it was received, its size (in bytes), the side of the line that is being monitored, and the result of the FCS (CRC) evaluation. The rest of the screen displays the frame data in hexadecimal representation (on left) and in character representation (on right). The character code used depends on the Character Code setting on the Display Setup menu—accessed via the analyzer window's Initial Display field.

HSV36.6. Viewing Results in Examine Mode

The High Speed V.35 Interface software offers the same two basic screens for examining a capture file in the Examine Mode as those described in the Run mode. Either of these screens may be displayed automatically upon entering the Examine Mode by selecting it for the initial Examine Mode display. This is described in the Initial Displays section of the "Applications" chapter in the *DA-30/31 Operating Manual*.

HSV36.6.1. Network Status Screen, Examine Mode

To access the Network Status screen, press F1 (NETWORK STATUS) from the Examine Mode Top Rack. This screen is identical to the Run Mode Network Status screen.

HSV36.6.2. Character Trace Screen, Examine Mode

The Character Trace screen for the Examine Mode looks just like the one described in Run Mode. If there are higher-level protocol packages loaded and running, you can display their traces by pressing F3 (protocol traces) from the Exam Mode Top Rack. You can then selectively display frames based on multiple (core & protocol-specific) criteria by pressing F8 (display filters). You can also access the Frame Detail screen by pressing F9 (FRAME DETAIL) from the protocol traces softkey rack. The core find commands, as well as any other protocol-specific find commands, are available by pressing F10 (find command) from either the character or protocol trace softkey rack.

HSV36.7. High Speed V.35 Clock Configurations

In the High Speed V.35 package, we have made every attempt to provide the flexibility of clock routing that is required for a protocol analyzer—while keeping the setup as straightforward as possible. This section explains the different possible clock routing configurations and how to setup the High Speed V.35 Interface for each configuration.

There are three fields that are used to route the clocks: Test Function, Clock Source and SD Clk Source. For each of the following configurations, a table is presented that shows you how to setup these clock routing fields for the corresponding configuration.

HSV36.7.1. Configuration 1

This is the default configuration (Figure HSV36-12) for the DA-30. In this configuration, the ST and RT clocks are generated by the DCE and provide the timing for SD and RD, respectively.

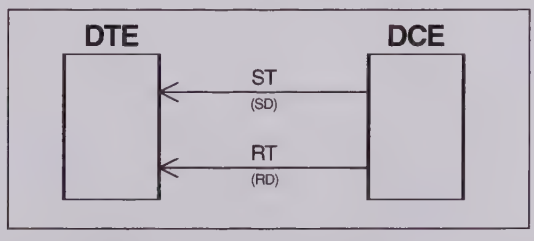


Figure HSV35-12 Clock Configuration 1

The clock routing setups for Configuration 1 are shown in Table 8.

Test Function	Clock Source	SD Clk Source
RECEIVE ONLY	EXTERNAL	ST
EMULATE DCE	INTERNAL	ST
EMULATE DTE	EXTERNAL	ST

Table 8 Clock Setups for Clock Configuration 1

HSV36.7.2. Configuration 2

In this configuration (Figure HSV36-13), the DCE generates the ST and RT clocks. RT provides the timing for RD. The DTE uses ST to clock data out on SD. The DTE also regenerates the ST on the TT circuit and synchronizes it with the data on SD. The DCE then uses TT to receive SD.

This implementation is often used at clock rates above 300 kHz to compensate for skew between ST and SD caused by propagation delay.

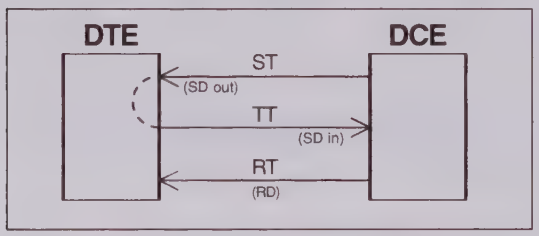


Figure HSV36-13 Clock Configuration 2

The clock routing setups for Configuration 2 are shown in Table 9.

Test Function	Clock Source	SD Clk Source
RECEIVE ONLY	EXTERNAL	TT
EMULATE DCE	INTERNAL	TT
EMULATE DTE	EXTERNAL	TT

Table 9 Clock Setups for Clock Configuration 2

HSV36.7.3. Configuration 3

In this configuration (Figure HSV35-14), the DTE generates a clock on TT. The DCE takes TT and loops it back on ST and RT. ST and RT provide the timing for SD and RD, respectively.

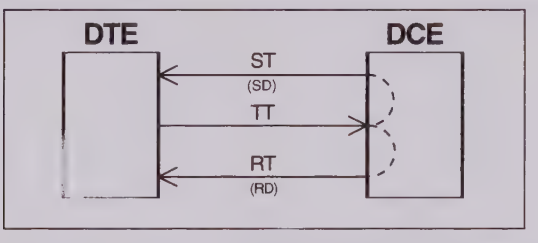


Figure HSV35-14 Clock Configuration 3

The clock routing setups for Configuration 3 are shown in Table 10.

Test Function	Clock Source	SD Clk Source
RECEIVE ONLY	EXTERNAL	ST
EMULATE DCE	EXTERNAL	ST
EMULATE DTE	INTERNAL	ST

Table 10 Clock Setups for Clock Configuration 3

HSV36.7.4. Configuration 4

This configuration (Figure HSV36-15) is the same as Configuration 3 except that the timing for SD is provided by TT.

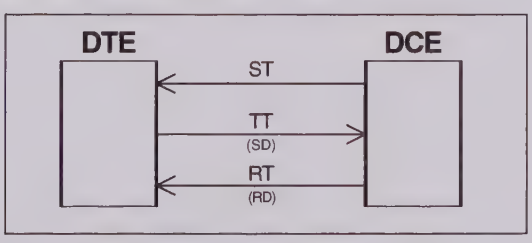


Figure HSV36-15 Clock Configuration 4

The clock routing setups for Configuration 4 are shown in Table 11.

Test Function	Clock Source	SD Clk Source
RECEIVE ONLY	EXTERNAL	TT
EMULATE DCE	EXTERNAL	TT
EMULATE DTE	INTERNAL	TT

Table 11 Clock Setups for Clock Configuration 4

HSV36.7.5. Configuration 5

In this configuration (Figure HSV36-16), the DTE generates TT which provides the timing for SD. The DCE generates RT which provides the timing for RD.

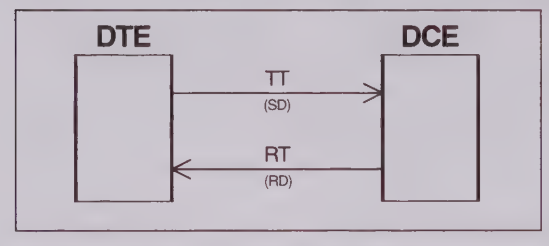


Figure HSV36-16 Clock Configuration 5

The clock routing setups for Configuration 5 are shown in Table 12.

Test Function	Clock Source	SD Clk Source
RECEIVE ONLY	EXTERNAL	TT
EMULATE DCE	INTERNAL	TT
EMULATE DTE	INTERNAL	TT

Table 12 Clock Setups for Clock Configuration 5

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V.36

RS-449 / V.36 PAL References

V36.1. Introduction

The RS-449/V.36 PAL keywords contained in the Layer Protocol Package (LPP) allow you to write protocol-specific Network Event Programs and use them in RS-449/V.36 applications. These keywords can be used by themselves or in combination with core keywords within an event. The Network Event Program simplifies the programming process with the softkey-guided mode.

PAL keywords are available in the Network Event Program Editor only when the RS449_V.36 LPP is loaded at Layer 1 of the DA-30 protocol stack. Using PAL with the RS-449/V.36 Interface is, essentially, a way to monitor and manipulate the interface control leads--overriding the settings on the Control Lead Setup screen. Table 5-1 lists the control leads and their mnemonics.

Control Leads	
Request To Send	RS
Clear To Send	CS
Data Mode	DM
Terminal Ready	TR
Receiver Ready	RR
Remote Loopback	RL
Local Loopback	LL
Test Mode	TM
Auxiliary #1	AUX 1
Auxiliary #2	AUX 2

Table 5-1 Control Leads and their Mnemonics

The PAL keywords are divided into the following two groups:

- protocol condition keywords
- protocol action keywords

V36.2. Protocol Condition Keywords

The protocol condition keywords allow you to evaluate frames received from a DTE or DCE as well as monitor the control leads. The protocol condition keywords available for evaluating received frames are:

- RCVD
- BAD.FCS
- ABORT
- PARITY
- FRAME ERROR

The protocol condition keywords available for monitoring the control leads are:

- RS
- CS
- DM
- TR
- RR
- RL
- LL
- TM
- UA1
- UA2

Note:

When using the control lead condition keywords, be sure to set the Monitor Control Leads field (of the Line Setup menu) to YES. Otherwise, the status of the control leads will be ignored.

The discussion of each keyword includes a syntactical model, a description and an example of its use.

RCVD

Syntax: DCE RCVD
DTE RCVD

Description: This condition is true when a valid frame is received. It can be used for either the DTE or DCE side of the interface.

Type: External

Example:
```
COND DCE RCVD
ACTN PROMPT "Frame received on DCE side"
```

Remarks: None

BAD.FCS

Syntax:

DCE BAD.FCS
DTE BAD.FCS

Description:

This condition is true when a frame with a bad frame check sequence is received. It can be used for either the DTE or DCE side of the interface.

Type:

External

Example:

```
COND DTE˙BAD.FCS
ACTN PROMPT "The frame has bad FCS"
```

Remarks:

None

ABORT

Syntax: DCE ABORT
DTE ABORT

Description: This condition is true when either an aborted frame or an aborted frame check sequence--following the previous flag--is received. It can be used for either the DTE or DCE side of the interface.

Type: External

Example:

```
COND DTE ABORT
     TIMEOUT count.down OR
ACTN PROMPT "Aborted frame or timeout"
```

Remarks: None

PARITY

Syntax:

DCE PARITY
DTE PARITY

Description:

This condition is true when there is a parity error in the received frame. It can be used for either the DTE or DCE side of the interface.

Type:

External

Example:

```
COND DTE PARITY
ACTN PROMPT " DTE received"
```

Remarks:

Parity is evaluated according to the Parity setting on the Line Setup menu.

FRAME ERROR

Syntax:

DCE FRAMING.ERROR
DTE FRAMING.ERROR

Description:

This condition is true when a framing error is detected. It can be used for either the DTE or DCE side of the interface.

Type:

External

Example:

```
COND DTE FRAMING.ERROR
ACTN PROMPT "FRAME ERROR. Evaluate now!"
```

Remarks:

None

RS

Syntax: RS ON
RS OFF

Description: This condition is true when the Request To Send (RS) pin makes a transition to the specified state. The valid states are ON and OFF.

Type: External

Example:
```
COND RS ON
ACTN PROMPT "RS pin is on"
```

Remarks: None.

CS

Syntax: CS ON
CS OFF

Description: This condition is to true when the Clear To Send (CS) pin makes a transition to the specified state. The valid states are ON and OFF.

Type: External

Example:
```
COND CS OFF
ACTN PROMPT "CS is now off"
```

Remarks: None.

DM

Syntax: DM ON
DM OFF

Description: This condition is true when the Data Mode (DM) pin makes a transition to the specified state. The valid states are ON and OFF.

Type: External

Example:

```
COND DM OFF
     TIMEOUT count.down OR
ACTN PROMPT "DM pin low or timeout occurred"
```

Remarks: None

TR

Syntax:

TR ON
TR OFF

Description: This condition is true when the Terminal Ready (TR) pin makes a transition to the specified state. The valid states are ON and OFF.

Type: External

Example:

```
COND TR OFF
ACTN PROMPT "TR switched off"
```

Remarks: None

RR

Syntax:

RR ON
RR OFF

Description: This condition is true when the Receiver Ready (RR) pin makes a transition to the specified state. The valid states are ON and OFF.

Type: External

Example:

```
COND RR ON
ACTN PROMPT "RR pin on"
```

Remarks: None

RL

Syntax:

RL ON
RL OFF

Description:

This condition is true when the Remote Loopback (RL) pin makes a transition to the specified state. The valid states are ON and OFF.

Type:

External

Example:

```
COND RL ON
ACTN PROMPT "RL pin is on"
```

Remarks:

None

LL

Syntax: LL ON
LL OFF

Description: This condition is true when the Local Loopback (LL) pin makes a transition to the specified state. The valid states are ON and OFF.

Type: External

Example:
```
COND LL ON
ACTN PROMPT "LL pin is on"
```

Remarks: None

V.36-12

TM

Syntax: TM ON
TM OFF

Description: This condition is true when the Test Mode (TM) pin makes a transition to the specified state. The valid states are ON and OFF.

Type: External

Example:
```
COND TM ON
ACTN PROMPT "TM pin is on"
```

Remarks: None

UA1

Syntax: UA1 ON
UA1 OFF

Description: This condition is true when the auxiliary #1 pin set (AUX 1), on the rear panel of the LIM, makes a transition to the specified state. The valid states are ON and OFF.

Type: External

Example:
```
COND UA1 ON
ACTN PROMPT "UA1 pin is on"
```

Remarks: None

UA2

Syntax: UA2 ON
UA2 OFF

Description: This condition is true when the auxiliary #2 pin set (AUX 2), on the rear panel of the LIM, makes a transition to the specified state. The valid states are ON and OFF.

Type: External

Example:
```
COND UA2 ON
ACTN PROMPT "UA2 pin is on"
```

Remarks: None

V36.3. Protocol Action Keywords

The protocol action keywords allow you to manipulate (drive) the interface control leads--overriding the settings on the Control Lead Setup screen. The protocol action keywords available for manipulating control leads are:

- RS
- CS
- DM
- TR
- RR
- RL
- LL
- TM
- UA1
- UA2
- UA.LED

The discussion of each keyword includes a syntactical model, a description and an example of its use.

> **Note:**
>
> Using PAL to override the Control Lead Setup Screen is only valid when Test Mode on the Line Setup is set to Emulate. If emulating a DTE, RS, TR, RL, LL, UA1 and UA2 are valid keywords. If emulating a DCE, the valid keywords are CS, DM, RR, and TM.

Since the protocol action keywords allow you to freely drive control leads ON or OFF, it is possible to inadvertently violate the RS-449/V.36 rules of control lead handshaking that are required for data transmission. At the same time, this freedom allows you to emulate/test for atypical or erroneous control lead handshaking.

RS

Syntax: RS ON
RS OFF

Description: This action drives the Request To Send (RS) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:
```
COND DM ON
ACTN RS ON
```

Remarks: None

CS

Syntax:

CS ON
CS OFF

Description: This action drives the Clear To Send (CS) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:

```
COND DM OFF
ACTN CS ON
```

Remarks: None

DM

Syntax:

DM ON
DM OFF

Description:

This action drives the Data Mode (DM) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:

```
COND TIMED count.down
ACTN DM ON
```

Remarks:

None

TR

Syntax:

TR ON
TR OFF

Description: This action drives the Terminal Ready (TR) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:

```
COND DM ON
ACTN TR ON
```

Remarks: None

RR

Syntax:

RR ON
RR OFF

Description:

This action drives the Receiver Ready (RR) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:

```
COND DM ON
ACTN RR ON
```

Remarks:

None

RL

Syntax:

RL ON
RL OFF

Description: This action drives the Remote Loopback (RL) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:

```
COND  KEY "Rr"
ACTN RL ON
```

Remarks: None

LL

Syntax:

LL ON
LL OFF

Description:

This action drives the Local Loopback (LL) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:

```
COND  KEY "L1"
ACTN LL ON
```

Remarks:

None

TM

Syntax: TM ON
TM OFF

Description: This action drives the Test Mode (TM) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:
```
COND  KEY "Tt"
ACTN TM ON
```

Remarks: None

UA1

Syntax:

UA1 ON
UA1 OFF

Description:

This action drives the auxiliary #1 pin set (AUX 1), on the rear panel of the LIM, to the specified state. The valid states are ON and OFF.

Example:

```
COND KEY "1"
ACTN UA1 ON
```

Remarks:

None.

UA2

Syntax: UA2 ON
UA2 OFF

Description: This action drives the auxiliary #2 pin set (AUX 2), on the rear panel of the LIM, to the specified state. The valid states are ON and OFF.

Example:
```
COND KEY "2"
ACTN UA2 ON
```

Remarks: None.

UA.LED

Syntax:

UA.LED UA1
UA.LED UA2
UA.LED RL
UA.LED LL

Description:

This action drives the front-panel U/A LED. The driving signal can come from either the AUX 1 pins (UA1), the AUX 2 pins (UA2), the Remote Loopback (RL) pin or the Local Loopback (LL) pin.

Example:

```
COND DM ON
ACTN UA.LED UA2
```

Remarks:

None.

HSV.36

High Speed RS-449 / V.36 PAL References

(Addendum to the RS-449/V.36 PAL References Document)

HSV36.1. Introduction

The programming features of the High Speed RS-449/V.36 Interface are practically the same as those of the V.36 Interface. However, the ability to saturate (flood) the network with user-defined frames has been added. Two new PAL keywords associated with the "flood network" functionality have been added to the Layer Protocol Package (LPP):

- FLOOD.NETWORK
- STOP.FLOOD.NETWORK.

The HS_V.36 PAL keywords contained in the Layer Protocol Package (LPP) allow you to write protocol-specific Network Event Programs and use them in RS-449/V.36 applications. These keywords can be used by themselves or in combination with core keywords within an event. The Network Event Program simplifies the programming process with the softkey-guided mode.

PAL keywords are available in the Network Event Program Editor only when the HS_V.36 LPP is loaded at Layer 1 of the DA-30 protocol stack. Using PAL with the High Speed RS-449/V.36 Interface is, essentially, a way to monitor and manipulate the interface control leads—overriding the settings on the Control Lead Setup screen. Table 5-1 lists the control leads and their mnemonics.

Control Leads	
Request To Send	RS
Clear To Send	CS
Data Mode	DM
Terminal Ready	TR
Receiver Ready	RR
Remote Loopback	RL
Local Loopback	LL
Test Mode	TM
Auxiliary #1	AUX 1
Auxiliary #2	AUX 2

Table 5-1 Control Leads and their Mnemonics

The PAL keywords are divided into the following two groups:

- protocol condition keywords
- protocol action keywords

HSV36.2. Protocol Condition Keywords

The protocol condition keywords allow you to evaluate frames received from a DTE or DCE as well as monitor the control leads. The protocol condition keywords available for evaluating received frames are:

- RCVD
- BAD.FCS
- ABORT
- FRAME ERROR

The protocol condition keywords available for monitoring the control leads are:

- RS
- CS
- DM
- TR
- RR
- RL
- LL
- TM

The discussion of each keyword includes a syntactical model, a description and an example of its use.

RCVD

Syntax: DCE RCVD
DTE RCVD

Description: This condition is true when a valid frame is received. It can be used for either the DTE or DCE side of the interface.

Type: External

Example:
```
COND DCE RCVD
ACTN PROMPT "Frame received on DCE side"
```

Remarks: None

BAD.FCS

Syntax:

DCE BAD.FCS
DTE BAD.FCS

Description:

This condition is true when a frame with a bad frame check sequence is received. It can be used for either the DTE or DCE side of the interface.

Type:

External

Example:

```
COND DTE BAD.FCS
ACTN PROMPT "The frame has bad FCS"
```

Remarks:

None

ABORT

Syntax: DCE ABORT
DTE ABORT

Description: This condition is true when either an aborted frame or an aborted frame check sequence—following the previous flag—is received. It can be used for either the DTE or DCE side of the interface.

Type: External

Example:

```
COND DTE ABORT
     TIMEOUT count.down OR
ACTN PROMPT "Aborted frame or timeout"
```

Remarks: None

FRAME ERROR

Syntax:

DCE FRAMING.ERROR
DTE FRAMING.ERROR

Description:

This condition is true when a framing error is detected. It can be used for either the DTE or DCE side of the interface.

Type:

External

Example:

```
COND DTE FRAMING.ERROR
ACTN PROMPT "FRAME ERROR. Evaluate now!"
```

Remarks:

None

RS

Syntax:

RS ON
RS OFF

Description:

This condition is true when the Request To Send (RS) pin makes a transition to the specified state. The valid states are ON and OFF.

Type:

External

Example:

```
COND RS ON
ACTN PROMPT "RS pin is on"
```

Remarks:

None.

CS

Syntax:

CS ON
CS OFF

Description: This condition is to true when the Clear To Send (CS) pin makes a transition to the specified state. The valid states are ON and OFF.

Type: External

Example:

```
COND CS OFF
ACTN PROMPT "CS is now off"
```

Remarks: None.

DM

Syntax:

DM ON
DM OFF

Description:

This condition is true when the Data Mode (DM) pin makes a transition to the specified state. The valid states are ON and OFF.

Type:

External

Example:

```
COND DM OFF
     TIMEOUT count.down OR
ACTN PROMPT "DM pin low or timeout occurred"
```

Remarks:

None

TR

Syntax:

TR ON
TR OFF

Description:

This condition is true when the Terminal Ready (TR) pin makes a transition to the specified state. The valid states are ON and OFF.

Type:

External

Example:

```
COND TR OFF
ACTN PROMPT "TR switched off"
```

Remarks:

None

RR

Syntax:

RR ON
RR OFF

Description:

This condition is true when the Receiver Ready (RR) pin makes a transition to the specified state. The valid states are ON and OFF.

Type:

External

Example:

```
COND RR ON
ACTN PROMPT "RR pin on"
```

Remarks:

None

RL

Syntax:

RL ON
RL OFF

Description: This condition is true when the Remote Loopback (RL) pin makes a transition to the specified state. The valid states are ON and OFF.

Type: External

Example:

```
COND RL ON
ACTN PROMPT "RL pin is on"
```

Remarks: None

LL

Syntax: LL ON
LL OFF

Description: This condition is true when the Local Loopback (LL) pin makes a transition to the specified state. The valid states are ON and OFF.

Type: External

Example:
```
COND LL ON
ACTN PROMPT "LL pin is on"
```

Remarks: None

TM

Syntax:

TM ON
TM OFF

Description:

This condition is true when the Test Mode (TM) pin makes a transition to the specified state. The valid states are ON and OFF.

Type:

External

Example:

```
COND TM ON
ACTN PROMPT "TM pin is on"
```

Remarks:

None

HSV36.3. Protocol Action Keywords

The protocol action keywords allow you to manipulate (drive) the interface control leads—overriding the settings on the Control Lead Setup screen. The protocol action keywords available for manipulating control leads are:

- RS
- CS
- DM
- TR
- RR
- RL
- LL
- TM
- UA.LED
- FLOOD.NETWORK
- STOP.FLOOD.NETWORK

The discussion of each keyword includes a syntactical model, a description and an example of its use.

> **Note:**
>
> Using PAL to override the Control Lead Setup Screen is only valid when Test Mode on the Line Setup is set to Emulate. If emulating a DTE, RS, TR, RL, LL, and UA.LED are valid keywords. If emulating a DCE, the valid keywords are CS, DM, RR, TM, and UA.LED.

Since the protocol action keywords allow you to freely drive control leads ON or OFF, it is possible to inadvertently violate the RS-449/V.36 rules of control lead handshaking that are required for data transmission. At the same time, this freedom allows you to emulate/test for atypical or erroneous control lead handshaking.

RS

Syntax:

RS ON
RS OFF

Description:

This action drives the Request To Send (RS) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:

```
COND DM ON
ACTN RS ON
```

Remarks:

None

CS

Syntax:

CS ON
CS OFF

Description:

This action drives the Clear To Send (CS) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:

```
COND DM OFF
ACTN CS ON
```

Remarks:

None

DM

Syntax:

DM ON
DM OFF

Description:

This action drives the Data Mode (DM) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:

```
COND TIMED count.down
ACTN DM ON
```

Remarks:

None

TR

Syntax:

TR ON
TR OFF

Description:

This action drives the Terminal Ready (TR) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:

```
COND DM ON
ACTN TR ON
```

Remarks:

None

RR

Syntax:

RR ON
RR OFF

Description:

This action drives the Receiver Ready (RR) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:

```
COND DM ON
ACTN RR ON
```

Remarks:

None

RL

Syntax:

RL ON
RL OFF

Description:

This action drives the Remote Loopback (RL) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:

```
COND  KEY "Rr"
ACTN RL ON
```

Remarks:

None

LL

Syntax:

LL ON
LL OFF

Description:

This action drives the Local Loopback (LL) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:

```
COND  KEY "Ll"
ACTN LL ON
```

Remarks:

None

TM

Syntax: TM ON
TM OFF

Description: This action drives the Test Mode (TM) pin to the specified state when the condition parameter is true. The valid states are ON and OFF.

Example:
```
COND  KEY "Tt"
ACTN TM ON
```

Remarks: None

UA.LED

Syntax:

UA.LED UA1
UA.LED UA2
UA.LED RL
UA.LED LL

Description:

This action drives the front-panel U/A LED. The driving signal can come from either the AUX 1 pins (UA1), the AUX 2 pins (UA2), the Remote Loopback (RL) pin or the Local Loopback (LL) pin.

Example:

```
COND DM ON
ACTN UA.LED UA2
```

Remarks:

None.

FLOOD.NETWORK

Syntax: FLOOD.NETWORK

Description: This action saturates the network with a user-defined string. In addition, the time interval between the frames may be selected (with 1 microsecond resolution) to control the saturation level of the network.

Example:

```
FLOOD.NETWORK "string"      TIME.GAP    [microseconds]
```

Remarks: None

STOP.FLOOD.NETWORK

Syntax: STOP.FLOOD.NETWORK

Description: This action stops the flood of the network after the current frame has been completely transmitted.

Example:

```
STOP.FLOOD.NETWORK
```

Remarks: None

T1 Operation Errata Sheet
March 1994

This is an errata sheet to the T1 Operation document, which is located in the *Line Interface Operation* binder.

As of Release 3.4.2, the maximum frame size on high speed WAN interfaces is 3984 bytes. The maximum frame size on standard WAN interfaces is 4012 bytes. This refers to the maximum frame size that can be displayed, not the maximum frame size that can be captured by the DA-3x. If a frame longer than the size limit is received, its length is displayed as the maximum length (3984 or 4012), and only that number of bytes is displayed in the frame detail and character trace. All frames, including those that exceed the maximum frame size, can be captured by the DA-3x.

Frame size references are made on the following pages of the T1 Operation document:

Section T1.6.1.1: Receiver Activity

page T1-31:

- The length of the longest frame, in bytes (maximum is 4012)

Section HST1.4.1: Receiver Activity

page HST1-8:

- Longest Frame - the size (in bytes) of the longest frame that has been received since receiving began. The maximum frame size that can be received is 3984 bytes.

T1 Line Interface Module Configuration

The DA-3x T1 Line Interface Module has undergone changes to make it compatible with ISDN Primary Rate Access (23B+D). Jumpers have been added to the module so that it can be reconfigured depending on where and how it will be used. The jumpers allow the following configurations:

- One set of jumpers allow the module to be configured for either carbon-microphone handsets (used mainly with T1) or with ELECTRET handsets (used mainly with ISDN).
- Another set of jumpers configure the module for 100Ω or 120Ω termination.
- A third set of jumpers configure the RJ-48 connector on the T1 Line Interface Module backplane.

The location of the jumpers on the T1 Line Interface Module is shown in Figure 1.

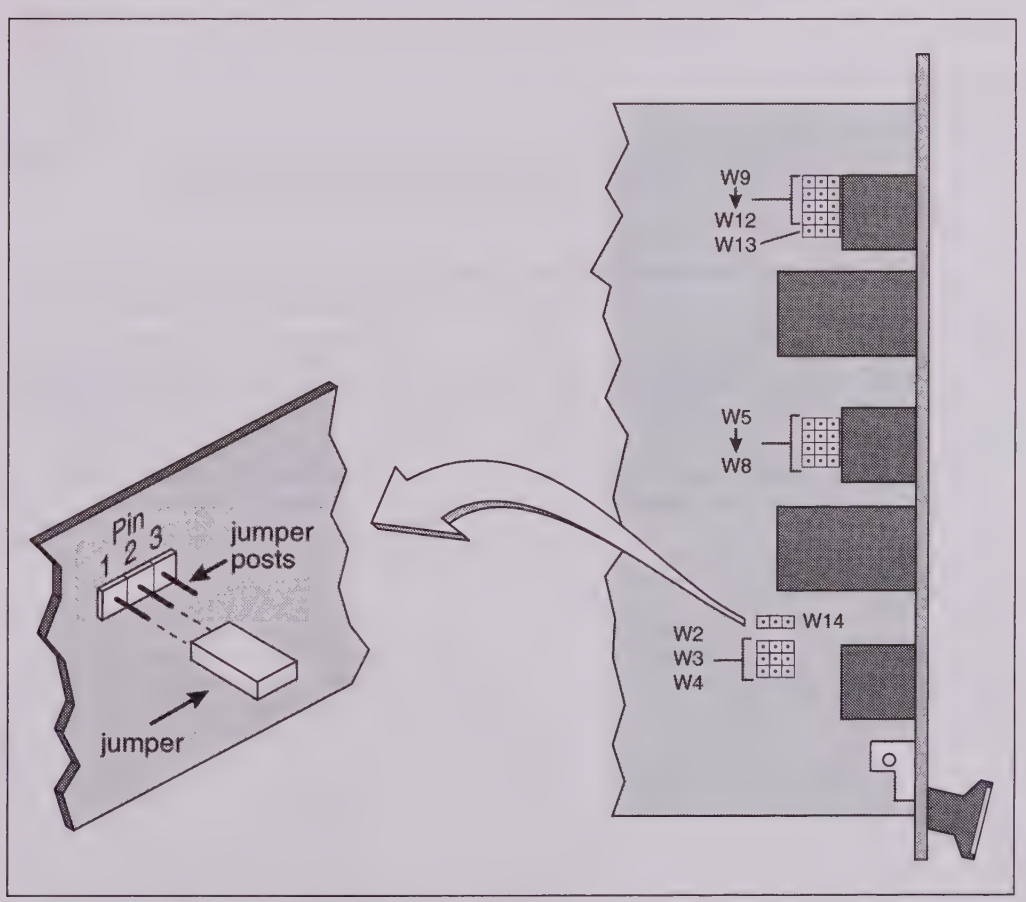


Figure 1 T1 Line Interface Module Jumper Location

Handset Configuration

To change the handset configuration, do the following:

1. Remove the T1 Line Interface Module.
2. Locate the jumper posts labeled W2-W4, as shown in Figure 1.
3. Install the jumper on the pins for the desired configuration, as listed in Table 1.

Configuration	Jumpers	Pins
ELECTRET handsets (ISDN)	W2-W4	pins 1 and 2
Carbon Microphone handsets (T1)	W2-W4	pins 2 and 3

Table 1 Jumper Settings for Handset Configuration

4. Re-install the T1 Line Interface Module and reboot the DA-3x.

> To install and remove the T1 Line Interface Module, refer to the "Installing Hardware Accessories" appendix of the *DA-30/31 Operating Manual*.

Termination Configuration

To configure the T1 Line Interface Module termination, follow steps 1 through 4 above, using the setting for jumpers W13-W14, as listed in Table 2.

- W13 controls To NET termination
- W14 controls To CPE termination

Configuration	Jumpers	Pins
100Ω termination (ANSI)	W13-W14	pins 1 and 2
120Ω termination (CCITT)	W13-W14	pins 2 and 3

Table 2 Jumper Settings for Termination Configuration

RJ-48 Connector Configuration

Jumpers W5-W12 affect the configuration of the RJ-48 connector on the T1 Line Interface Module backplane, shown in Figure 2.

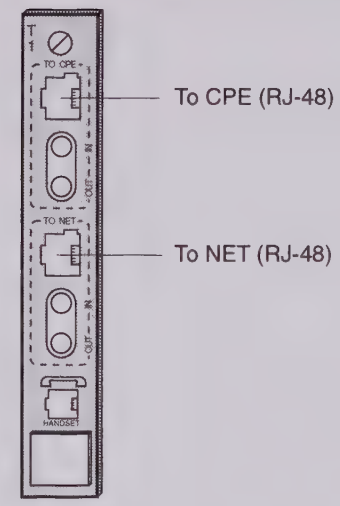


Figure 2 RJ-48 connector on the T1 Line Interface Backplane

To configure the RJ-48 connector, follow steps 1 through 4 in the "Handset Configuration" section of this document, using the jumper settings in Table 3.

Configuration	Jumpers	ISO/IEC 10173	Japan
To NET (RJ-48)	W5-W8	pins 1 and 2	pins 2 and 3
To CPE (RJ-48)	W9-W12	pins 1 and 2	pins 2 and 3

Table 3 Jumper Settings for RJ-48 Connector Configuration

Pin-outs for each connector configuration are shown in Tables 4 and 5.

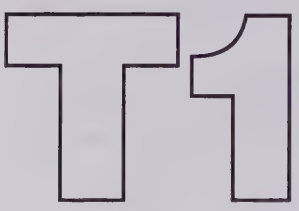
Pin	To CPE	To NET
1	Rx Ring	Tx Ring
2	Rx Tip	Tx Tip
3	N/C	N/C
4	Tx Ring	Rx Ring
5	Tx Tip	Rx Tip
6	N/C	N/C
7	N/C	N/C
8	N/C	N/C

Table 4 ISO/IEC 10173 (ANSI/CCITT) Configuration

Pin	To CPE	To NET
1	N/C	N/C
2	N/C	N/C
3	Tx Ring	Rx Ring
4	Rx Ring	Tx Ring
5	Rx Tip	Tx Tip
6	Tx Tip	Rx Tip
7	N/C	N/C
8	N/C	N/C

Table 5 Japanese Configuration

Fourth Edition October 1993 Release 3.4 and after



T1 Operation

This section describes the interface- and protocol-specific operation of the DA-30 T1 interface.

T1.1. Introduction to T1

T1 is a single high-speed communications facility (or circuit) used for the digital, two-way transmission of voice, data or video. The technology to produce and use the T1 capability has been in existence in North America since 1962, but was generally restricted to use by the carriers and telephone companies to transmit voice signals between central offices. It is only since 1983 that T1 has been offered as a service to telephone subscribers through regulated tariffs.

When T1 was first introduced, signals were framed for the sending of 24 separate PCM (Pulse Code Modulated) voice frequency channels over the circuit. Each channel can be transmitted at 64,000 bits per second; when multiplexed together, this creates a total transmission rate of 1,536,000 bits per second. However, one bit is added to each T1 frame (consisting of 24 8-bit channels) for synchronization of the T1 multiplexers. This control bit makes each T1 frame a total of 193 bits in length (see Figure T1-1).

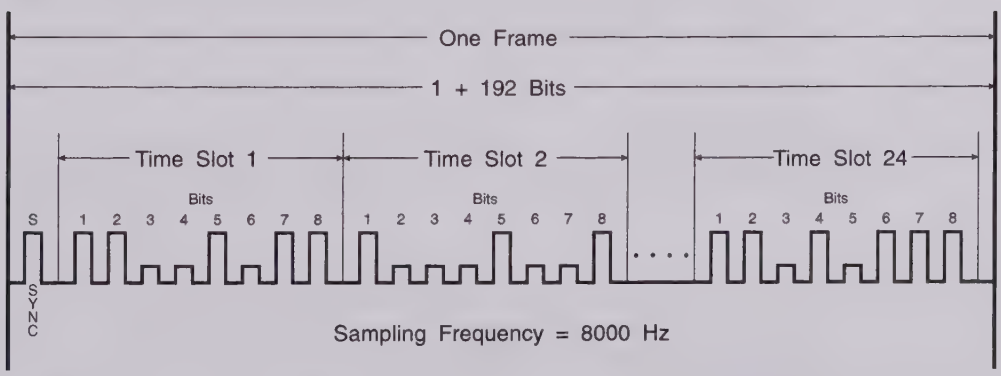


Figure T1-1 One T1(D4) Frame

T1 frames repeat 8000 times per second, so this control (or overhead) bit effectively adds an additional 8000 bits per second to the frame. Total T1 bandwidth (called DS1 or Digital Signal, Level 1) is thus 1,544,000 bits per second (usually designated as 1.544 Mbps). DS1 is also sometimes referred to as the T1 pipe. This type of framing is called D4. Each of the 24 individual channels is designated as a DS0, with its own 64 kilobits per second (or kbps) of

dedicated bandwidth. T1 switching equiment allows the carrier to switch a DS0 into any of the 24 slots in the DS1.

As technology advanced and digital carrier systems improved, it became unnecessary to use the entire 8 kbps control bandwidth for multiplexer synchronization, and new types of T1 framing evolved. One is called Superframing (SF), also referred to (confusingly) as D4. The other is Extended Superframing (ESF).

There are two types of Superframing, each of which organizes D4 frames into groups of twelve. In the type of Superframing known as Channel Associated Signaling, the overhead bit (the 193rd bit) of each D4 frame is used for synchronization in the odd-numbered frames, where it is known as the Ft bit. In even-numbered D4 frames, the overhead bit is called the Fs bit, and is used both for synchronization and for identifying which frames carry signaling information (dialing, idle, busy, on- and off-hook). The other type of Superframing in use is Common Channel Signaling. Here, the Ft bits are used for frame alignment, but the signaling information indicators are carried in another part of the frame, and the Fs bits are not used.

Extended Superframing extends the frame boundary to groups of 24 regular (D4) frames, and uses only 2 kbps of the available 8 kbps control bandwidth for synchronization. Of the remaining bandwidth, 2 kbps is used for error checking (the Cyclic Redundancy Checksum known as CRC6), and 4 kbps, called the Facility Data Link, is used for continuous non-disruptive circuit diagnostics. Information from the Facility Data Link allows a network manager to see when a circuit begins to fail, so the problem can be addressed before the line is totally out of service.

In 1989, a service called Fractional T1 became available, allowing customers to purchase individual DS0 channels from the total DS1 bandwidth. Fractional T1 allows subscribers to buy one or more DS0s (the amount of bandwidth needed by their network application) in 64 kbps increments, taking advantage of the greater savings of T1, without paying for (and probably wasting some part of) a complete T1 pipe. The DS0s purchased by Fractional T1 customers can be contiguous within the T1 pipe (e.g. channels 2,3,4 and 5 for a total of 256 kbps bandwidth), but this is not necessary. The carrier's switch can just as easily distribute these four DS0s into channels 1,5,14 and 22 of the DS1 at the sending end, and then correctly de-multiplex them for the customer at the receiving end.

Standard DS1 transmission uses Alternate Mark Inversion (or AMI) encoding. This means that signals designating logical ones are bipolar from the zero signal, which is always ground zero. If a positive bipolar one is sent, the next bipolar one must be negative. If T1 hardware or facilities fail to maintain this pattern of alternating polarity, a Bipolar Violation (BPV) occurs, which triggers certain alarms to the T1 equipment. See Figure T1-2.

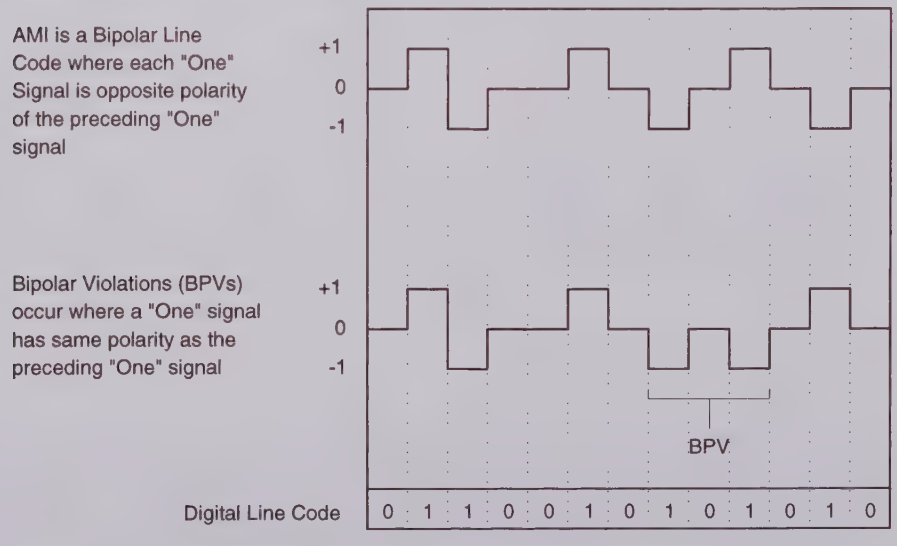

AMI is a Bipolar Line Code where each "One" Signal is opposite polarity of the preceding "One" signal
+1
0
-1
Bipolar Violations (BPVs) occur where a "One" signal has same polarity as the preceding "One" signal
+1
0
-1
BPV
Digital Line Code
0 1 1 0 0 1 0 1 0 1 0 1 0

Figure T1-2 Alternate Mark Inversion Code and Bipolar Violations

In order to maintain synchronization, one requirement of AMI is that no more than 15 consecutive zeros can be sent. When T1 was used only to carry voice signals, this requirement posed no difficulties. However, when carrier customers gained access to T1 (to both DS1 and, later, to Fractional T1), data transmission on T1 circuits became a requirement. This made the "no more than fifteen consecutive zeros" rule a problem, since the telephone companies cannot dictate the pattern of ones and zeros in a customer's data stream.

One solution to this difficulty is the arbitrary insertion (stuffing) of a one bit into each eight-bit grouping; the extra one bit is removed (destuffed) at the receiving end. This algorithm solves the problem of fifteen consecutive zeros, but wastes a great deal of bandwidth (each 64 kbps channel is effectively reduced to a data rate of 56 kpbs). The accepted alternative to bit-stuffing is the use of a Line Code called B8ZS (Bipolar with Eight-Zero Substitution). B8ZS maintains a balance of positive and negative ones signals, but inserts deliberate Bipolar Violations on the line to maintain bits density. The sending and receiving equipment monitor the level of Bipolar Violations and correctly discriminate the "real" BPVs from those deliberately inserted. With B8ZS, the entire 64 kbps bandwidth of a DS0 is available to the customer using T1 for data transmission. Carriers sell this product to customers with B8ZS-compatible equipment under the name Clear Channel Capability (CCC), because the entire 64 kbps channel is clear for data transmission.

B8ZS is a relatively new Line Code and is generally only used with Extended Superframing. Not all equipment present in today's T1 network is B8ZS- or ESF-compatible. Another way to attain the Clear Channel Capability with older T1 equipment is by using the AMI Line Code with a special kind of framing known as ZBTSI (Zero Bit Time Slot Interchange). The ZBTSI capability is created in the terminal equipment, as opposed to the repeaters, multiplexers, etc. of the T1 carrier system. ZBTSI can only be used with Extended Superframing, and modifies it slightly, in that 2 kbps of the ESF Facility Data Link is used for the ZBTSI algorithm. This leaves 2 kbps for the Facility Data Link, 2 kbps for multiplexer synchronization and 2 kbps for the CRC. Extended Superframing with ZBTSI is usually abbreviated ESFz.

T1.2. The DA-30 T1 Option

The DA-30 T1 option includes the following:

- T1 Line Interface Module (printed circuit board)
- Line Interface Software (3.5" diskette)
- Layer Protocol Software (3.5" diskette)
- Documentation

The T1 Line Interface Module is installed, together with a WAN Feature Module, in Slots 4 and 5, or Slots 6 and 7, of the DA-30 Mainframe. See the *DA-30/31 Operating Manual* for hardware installation instructions.

Note:

If you are using the T1 Line Interface Module with WAN Feature Module BN 9305/00.07, the total bandwidth capacity of the DA-30 is limited to 256 kpbs. This is a limitation of the WAN Feature Module, not of the T1 Line Interface Module. Full T1 (1.544 Mbps) bandwidth support is not possible without the WAN Feature Module BN 9305/00.17 (also called "High Speed WAN").

The Line Interface and Layer Protocol Software is installed on the DA-30's hard disk. If your DA-30 is delivered from the factory at the same time as your T1 Option, then the software is already installed (you can confirm this with the Version Information screen). If you receive the T1 Option after your original purchase, you must install the software yourself. See the *DA-30/31 Operating Manual* for software installation instructions.

T1.3. Connecting to the Network

Carriers who sell T1 service commonly delineate the point where their responsibility for the service ends and the customer's responsibility begins by the terms NET (designating their equipment) and CPE (Customer Premise Equipment, meaning equipment owned by the customer, usually a T1 Multiplexer, Router or similar device). To maintain a fixed point-of-reference for the T1 line side, the DA-30 also differentiates between NET and CPE. Figure T1-3 depicts the DA-30's test points on a T1 circuit, and the test directions, relative to the NET or the CPE.

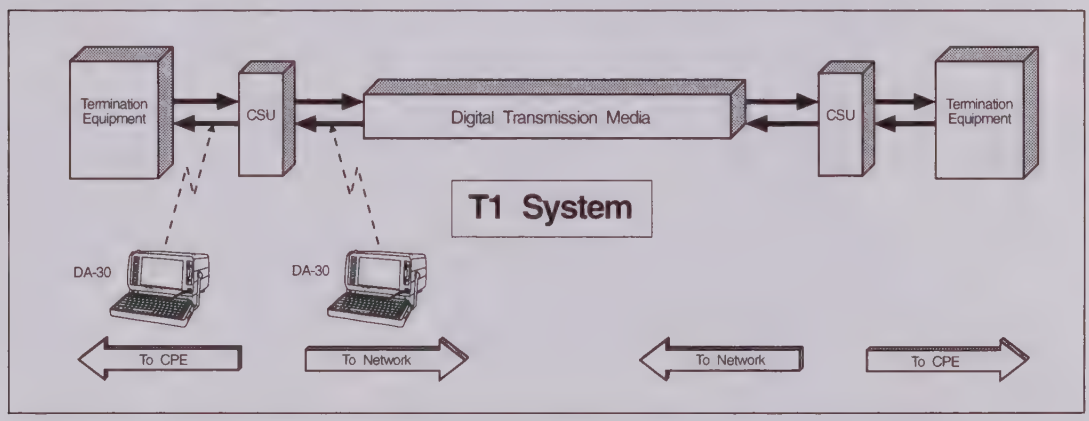


Figure T1-3 DA-30 T1 Test Points

The network connectors on the T1 Line Interface Module are similarly differentiated between the NET and CPE directions. See Figure T1-4.

Figure T1-4 DA-30 T1 Network Connections

One set of connectors (TO CPE) is dedicated to accepting signals from, and/or generating signals back towards, the CPE. The other set of connectors (TO NET) analyzes signals from, and/or generates signals back towards, the NET. Within each set of connectors, either the Bantum or the RJ48C connector may be used. In a normal monitoring mode, the connectors are wired internally for through connection (that is, the signals pass straight through) as follows:

TO CPE IN is connected to TO NET OUT
TO CPE OUT is connected to TO NET IN

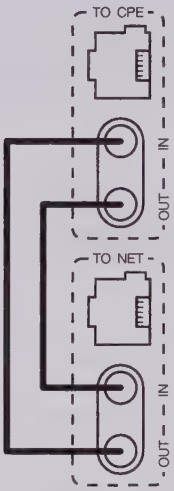


Figure T1-5 Default Internal Connection of CPE and NET Connectors

Which connector(s) you choose to use, and the number of connections you make, is determined by the type of T1 testing you are performing. For passive monitoring of one line side, where the DA-30 is simply used to access the data from the T1 for the purpose of protocol analysis at upper layers, you need only the IN side of the Bantum connection (or the receive pair on the RJ48C). A single Bantum connection to the TO NET IN or TO CPE OUT connector forwards the data from the one side of the line (the side going from the NET to the CPE) to the DA-30 for analysis. A single Bantum connection to the TO NET OUT or TO CPE IN connector accesses the data from the other side of the line (from the CPE to the NET). See Figure T1-6.

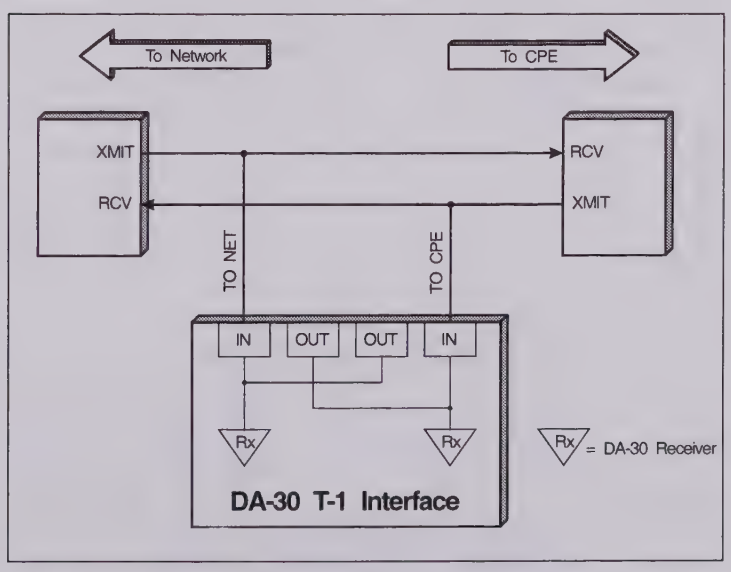


Figure T1-6 Network Connection Via Bantum Connectors With DA-30 as a Monitor

To access data from both line sides simultaneously requires either two Bantum connections (TO NET IN and TO NET OUT, or TO CPE IN and TO CPE OUT), or a single RJ48C connection to either TO CPE or TO NET.

If the DA-30 is being used to transmit data onto the T1, the IN and OUT lines from the TO CPE and TO NET connections are no longer bridged together, and one of the OUT lines becomes a transmit path from the DA-30 to the NET or CPE. If the DA-30 is to act as a NET, you need both IN and OUT paths between the TO CPE connector(s) and the CPE. Similarly, if the DA-30 is to act as a CPE, connections must exist between the NET and both the IN and OUT connections on the TO NET connector. The advantage of the RJ48C connector for these configurations is that both the transmit and receive paths are enabled with one cable, while you must use two cables to connect both the IN and OUT sides of the Bantum connections. See Figures T1-7 and T1-8.

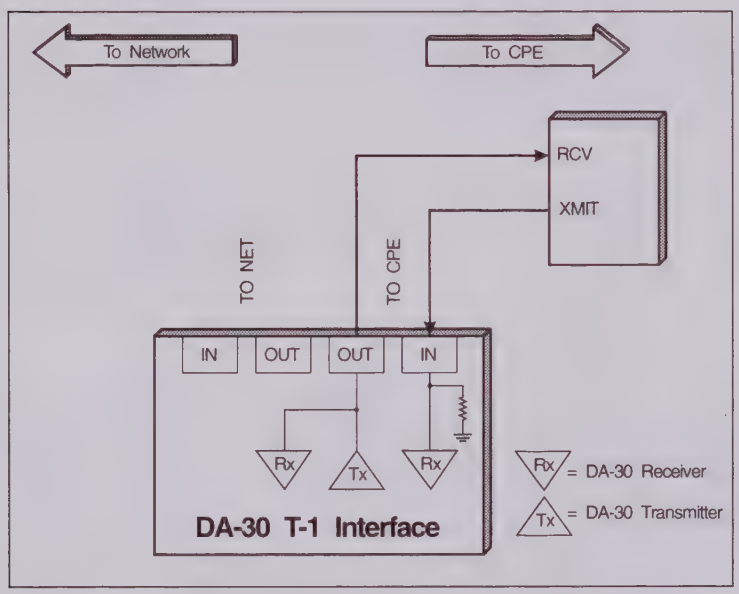


Figure T1-7 Connecting the DA-30 to Act as a NET

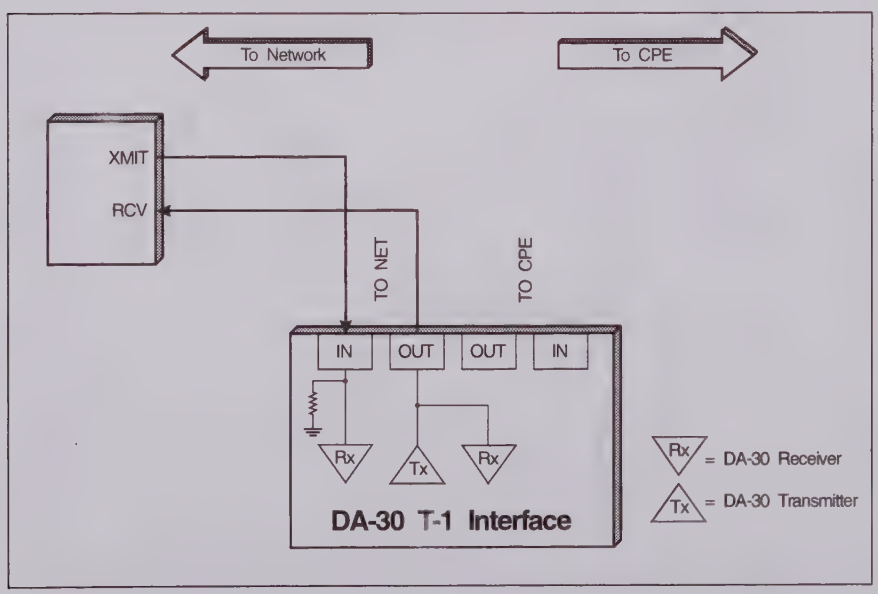


Figure T1-8 Connecting the DA-30 to Act as a CPE

The DA-30 can also participate actively on the T1 circuit in one of two Drop & Insert modes, acting as either a NET or CPE. In these modes, the DA-30 demultiplexes the D4 frame into its component DS0 channels, just as T1 carrier equipment demultiplexes the D4 frame into Fractional T1. You can then specify certain channels to be "dropped" (i.e. the signals are removed from the channel), and replaced ("inserted") with signals generated by the DA-30. This process, which is the same regardless of the TO NET or TO CPE orientation, is depicted in Figure T1-9. In Step 1, the D4 frame is received by the T1 Interface, which demultiplexes it into its 24 component time slots. In Step 2, channels 1, 2 and 3 are dropped (shown as the signals in the channel being pushed into the bit bucket) and replaced by signals (data and/or voice) from the DA-30. In Step 3, the re-multiplexed frame is transmitted back to the line, with the newly inserted signals in channels 1, 2 and 3.

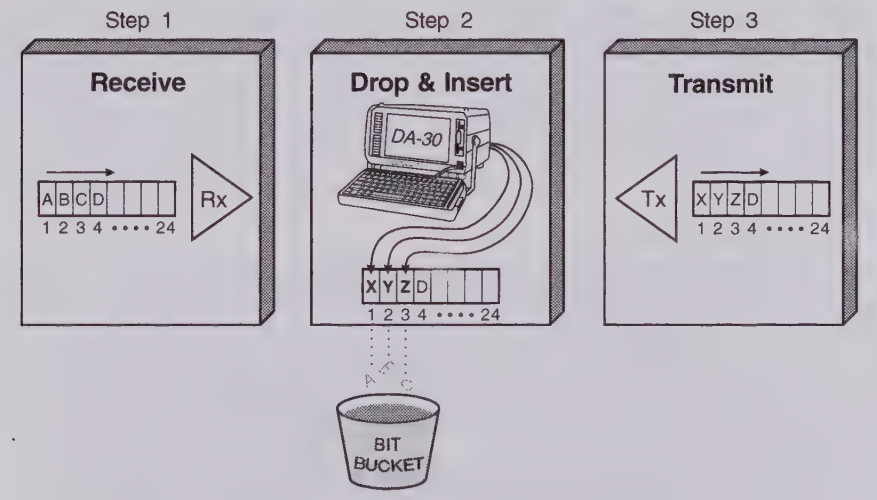


Figure T1-9 Drop & Insert Mode

For Drop & Insert testing, or any time the DA-30 is to become an active participant in the T1 network, it must be connected in series with the network in the direction of the transmit path. That is, at least one line side must be received on an IN path, and returned by an OUT path to the same line side to maintain a complete T1 circuit. You can create this with two, three or four Bantum cables, or with two cables attaching to the RJ48C connectors. See Figure T1-10.

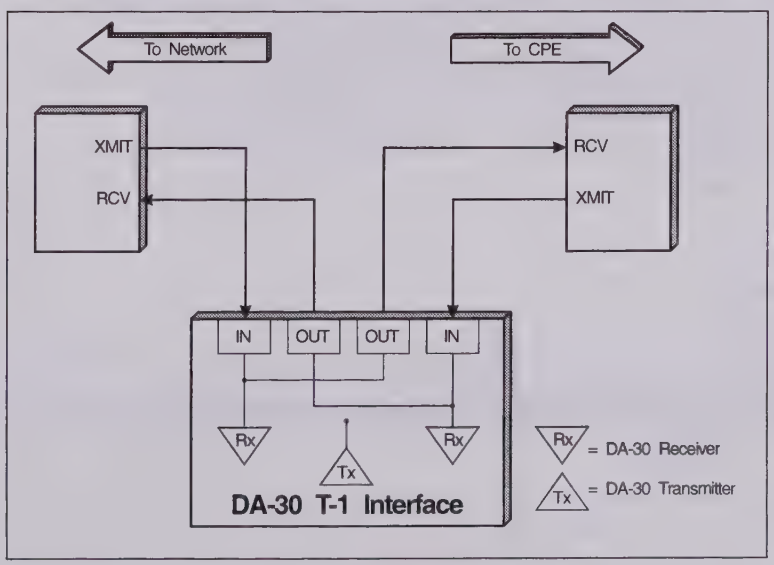


Figure T1-10 Connecting the DA-30 in Series with the T1

If your test point is not between a NET device and a CPE device (for instance, if it is between two repeaters, which are both NET-type devices), then you must establish your own points of reference to correlate line sides with the naming convention. That is, you may need to think of TO CPE as "EAST" and TO NET as "WEST". In any case, you need only recall that the "IN" and "OUT" sides of each set of Bantum connectors tie into different line sides. Conversely, connecting to the network with the RJ-48C accesses both lines sides. If you are using the RJ-48C connectors and want to restrict the DA-30's analysis to a single line side, a filter with this function can be set through the Data Channel Setup menu.

T1.3.1. Connecting to the Handset Jack

The DA-30 T1 Interface has a standard RJ-11 connector for a handset. This port can monitor one fractional channel of a T1 circuit in any mode and can also be used to transmit a voice signal on one channel in any transmit mode. This connection is not intended to support exhaustive voice-grade diagnostics; it is intended only as a convenience for those wishing to communicate verbally with a handset to others working with the same T1.

T1.4. Completing the Line Setup

To adjust the way the DA-30 interacts with a T1 network (for instance, to enable Drop and Insert testing, instead of passive monitoring), you must configure the T1 Line Setup from the Slot Window. To do so, move the cursor to the appropriate Slot and press F2 (line setup). The top-level Setup menu leads to further choices for configuring each of the following:

- T1 Line Setup
- Data Channel Setup
- Voice Channel Setup

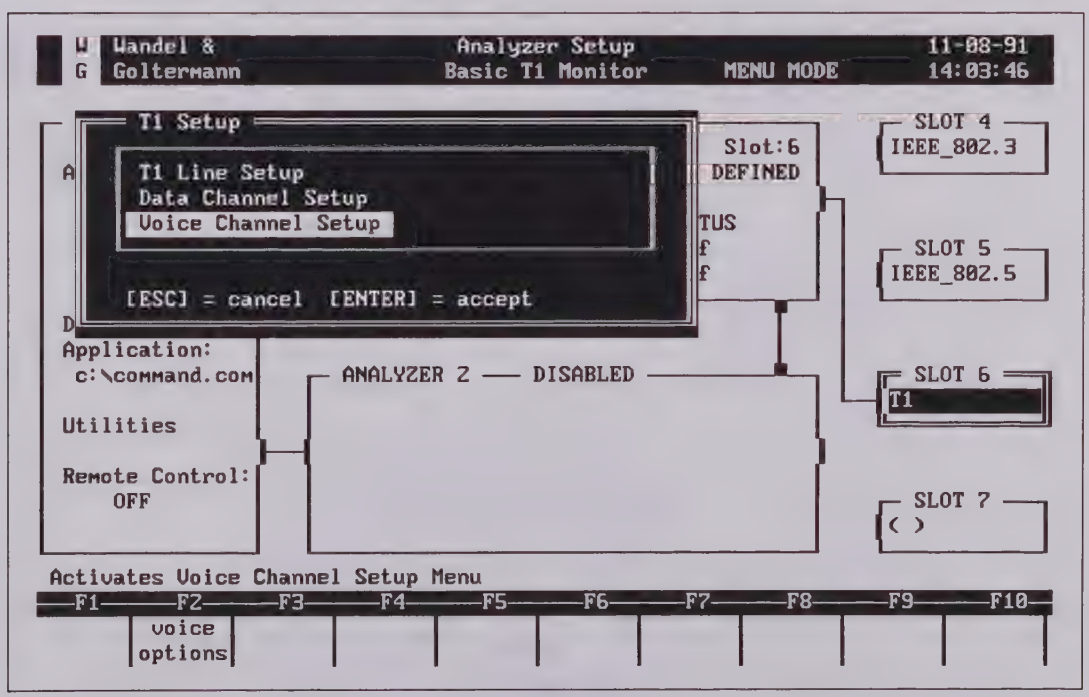


Figure T1-11 T1 Top-Level Setup Menu

Each individual sub-menu is accessed by moving the cursor to the appropriate field on the top-level menu, and pressing F2. Each sub-menu is explained in detail in the following sections.

T1.4.1. The T1 Line Setup

The T1 Line Setup menu provides choices for the type of T1 testing being done, Framing and Line Code parameters, and selection of specific fractional data and voice channels from the total T1 pipe. The data and voice channels are then configured from the Data Channel Setup and Voice Channel Setup sub-menus.

Figure T1-12 shows the T1 Line Setup menu. The first four parameters are common to the complete setup. The field selections for the remainder of the menu (Receive and Transmit side parameters) vary with the type of testing performed (choice of Test Function). Two columns are present under the Receive side menu, which reflects the fact that the T1 Interface simultaneously receives signals from two receivers (two line sides). There is only one column of parameters available for the Transmit side in this menu because the DA-30 is only capable of transmitting in one direction at a time.

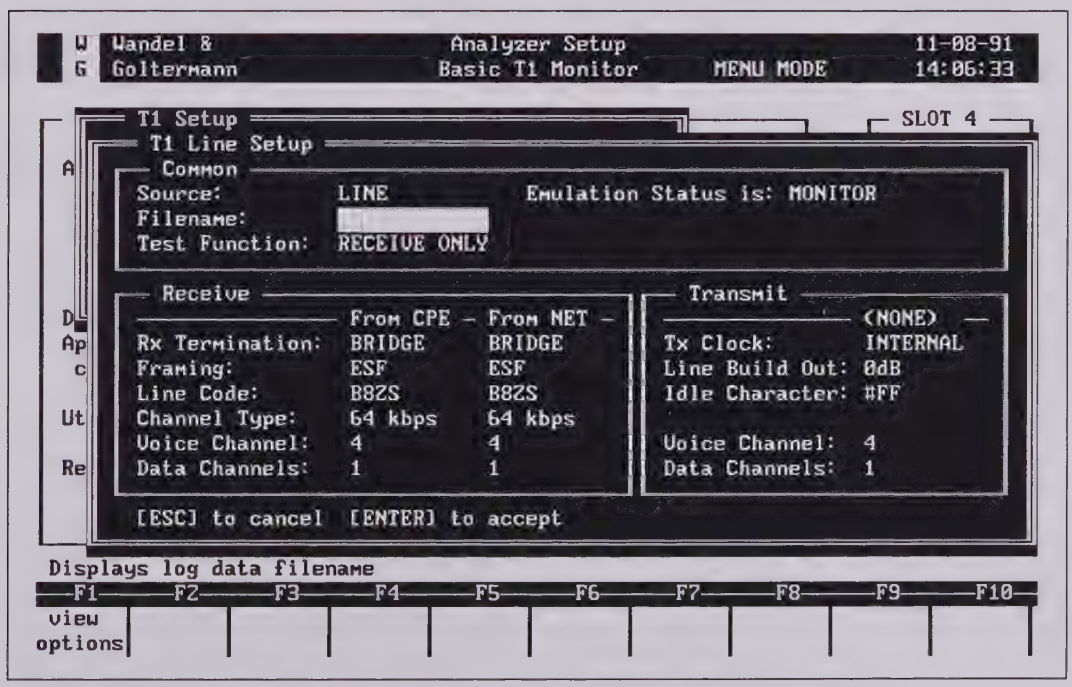


Figure T1-12 T1 Line Setup Menu

T1.4.1.1. Source

Press F1 to view options for Source, which are LINE or FILE. If you are analyzing data from the network, select LINE (which is the default value). If you wish to playback and analyze data from a file, select FILE. Press Enter to select the option under the cursor, or Escape to return to the T1 Line Setup menu.

T1.4.1.2. Filename

If you select FILE as your data source, you must provide a filename in this field. Press F1 to view a directory listing of file choices. The logged files present on the DA-30 hard disk are named with extensions indicating the line interface used to log them. For instance, a file called MYFILE.ETH was logged with an Ethernet interface, and should be played back to the same interface. Files logged with the T1 interface are named with a .T1 extension. These are the only files that should be played back to the T1 Line Interface.

T1.4.1.3. Emulation Status is

The value in this field is either MONITOR or EMULATE, and varies with the option selected for Test Function (below). The field is not selectable, and is shown only for reference. In MONITOR mode, the DA-30 is passive and cannot transmit. In EMULATE mode, the DA-30 is capable of generating signals to the T1 line.

T1.4.1.4. Test Function

The five choices for the DA-30's T1 Test Function are RECEIVE ONLY, TX ORIG NET, TX ORIG CPE, TX D&I NET and TX D&I CPE. Each option is explained below:

RECEIVE ONLY — the DA-30 acts as a passive monitor, and is connected to the network as shown in Figure T1-6. Emulation Status is MONITOR, the receivers are From CPE and From NET, both receivers have bridged terminations, and the transmitter is not enabled.

TX ORIG NET — the DA-30 acts as a NET device transmitting towards the CPE. The T1 Interface is connected as shown in Figure T1-7 and Emulation Status is EMULATE. It receives on TO CPE IN (shown in the Receive Menu as From CPE) and transmits on TO CPE OUT. The DA-30 receives what it transmits, therefore, it also receives on TO CPE OUT. The Receive side is set as terminated within the DA-30, coming from the CPE, and bridged going to the CPE. The source of the Transmit Clock is Internal.

TX ORIG CPE — the DA-30 acts as a CPE device transmitting towards the NET. The T1 Interface is connected as shown in Figure T1-8 and Emulation Status is EMULATE. It receives on TO NET IN (shown in the Receive Menu as From NET) and transmits on TO NET OUT. The DA-30 receives what it transmits, therefore, it also receives on TO NET OUT. The Receive side is set as terminated within the DA-30, coming from the NET, and bridged going to the NET. The source of the Transmit Clock is Internal.

TX D&I NET — the DA-30 is dropping the signal from the TO NET IN line and sending its own data out on the TO CPE OUT line. The TO NET OUT line is bridged to the TO CPE IN line. The T1 Interface is connected in series with the circuit (similar to Figure T1-10) and Emulation Status is EMULATE. The Receive side is set as terminated within the DA-30, coming from the NET, and bridged coming from the CPE. The Transmit Clock is referenced from the NET, which is selected in the Menu as LOOP TIMED.

TX D&I CPE — the DA-30 is dropping the signal from the TO CPE IN line and sending its own data out on the TO NET OUT line. The TO CPE OUT line is bridged to the TO NET IN line. The T1 Interface is connected in series with the circuit (similar to Figure T1-10) and Emulation Status is EMULATE. The Receive side is set as terminated within the DA-30, coming from the CPE, and bridged coming from the NET. The Transmit Clock is referenced from the CPE, which is selected in the Menu as LOOP TIMED.

Move the cursor to the desired Test Function and select it by pressing Enter. Press Escape to return to the T1 Line Setup menu without making a selection.

T1.4.1.5. Rx Termination

The value in this field determines how the receiver is terminated. Proper values are inserted in the two columns of Receive side parameters by the choice of Test Function (explained above), however, your particular application may require you to alter the default values. The choices include BRIDGE, TERMINATE and DSX MON. Each is explained below.

BRIDGE — The receiver presents a high impedance (> 1000 Ω) condition to the line, so that no alteration to the signal shape or amplitude is caused by the Interface circuitry. If your application requires no modification to the standard connection of TO CPE IN to TO NET OUT and TO NET IN to TO CPE OUT, then both Receiver Terminations should be bridged.

TERMINATE — The receiver presents a 100 Ω load to the line, which creates a standard termination for a T1 circuit. Signals into a terminated receiver are read by the DA-30 and go no further. If your application requires that a line connection be terminated at the test point, then select TERMINATE.

DSX MON — DSX MON is an abbreviation for Digital Cross-Connect Monitor. If DSX MON is selected, the receiver expects the signal from the source to be linearly attenuated by approximately 20 dB, and compensates for the attenuation prior to passing it back to the line. DSX MON is a valid selection for a receiver with an external source (the signal originating external to the DA-30), but is not a valid selection for line connections where the DA-30 is the source. If your application requires receiving data from a DSX Monitor, select DSX MON.

Note:

Any of these options may be selected for either of the Receiver Termination fields. It is therefore possible to select an invalid or nonsensical configuration, or one that is disruptive to data on the circuit. Great care should be taken in selecting termination values other than the defaults, particularly if the T1 Interface is connected in series with the circuit.

The following chart summarizes 1) the mapping of each receiver and the transmitter 2) the receiver termination, and 3) the source of the transmit clock for each possible Test Function.

Test Function	Receiver 1 / Rx Termination	Receiver 2 / Rx Termination	Transmitter	Transmitter Timing
RECEIVE ONLY	From CPE / BRIDGE	From NET / BRIDGE	None	Not Used
TX ORIG NET	From CPE / TERMINATE	To CPE / BRIDGE	To CPE	INTERNAL
TX ORIG CPE	To NET / BRIDGE	From NET / TERMINATE	To NET	INTERNAL
TX D&I NET	From CPE / BRIDGE	From NET / TERMINATE	To CPE	LOOP TIMED
TX D&I CPE	From CPE / TERMINATE	From NET / BRIDGE	To NET	LOOP TIMED

Figure T1-13 Field Entries Determined by Choice of Test Function

T1.4.1.6. Framing

The Framing field allows you to select the kind of framing in use on the T1 circuit. Choices include:

- ESF — Extended Superframing, which is the default
- SF (D4) — Superframing, which implies standard D4 frames in a 12-frame multiframe
- ESFz — Extended Superframing with ZBTSI

If the Test Funtion specified is RECEIVE ONLY, different framing options may be selected for the two connections on the Receive side, although the usefulness of this configuration is rare. For any form of emulation, the framing option should be the same for both connections on the Receive side. The option chosen here also determines the framing used by the Transmitter, when enabled. It is not possible to receive with one kind of framing and transmit with a different kind.

T1.4.1.6.1. SF Alarms

If you have selected Superframing (SF) as your framing option, you may make further selections for Errors and Alarms. Press F2 to access a menu for SF Errors and Alarms.

T1.4.1.6.1.1. Frame Errors

Depending on whether your Superframing T1 equipment supports the use of Fs bits for framing, you may choose to monitor both the Fs and Ft bits in the Superframe for frame errors, or only the Ft bits.

- Ft/Fs — both Ft and Fs bits are monitored for frame errors. This monitoring scheme is typical of Channel Associated Signaling T1 systems, which are most commonly used in North America today. This choice is the default.
- Ft — only the Ft bits are monitored for frame errors. This type of monitoring is typically used with Common Channel Signaling.

If you are not sure which type of signaling equipment is in use in your network, consult your carrier.

T1.4.1.6.1.2. SF Yellow Alarms

This field determines which of two conditions in the T1 frame is interpreted as a yellow alarm by the DA-30.

- BIT 2 LOW — the DA-30 detects a yellow alarm when bit 2 in every frame within the Superframe is low. This is the default selection.
- INVERTED Fs BIT — the DA-30 detects a yellow alarm when the Fs bit in Frame 12 of the Superframe is inverted.

T1.4.1.7. Line Code

The Line Code field allows you to select one of two possibilities:

- AMI — Alternate Mark Inversion
- B8ZS — Bipolar with Eight-Zero Substitution, which is the default

The Line Code option is usually the same for both connections on the Receive side, but it is possible to have different line codes specified in the two columns. If the DA-30 is emulating, the line code used by the Transmitter is determined by the option chosen on the "To" receiver.

If ESFz is selected in the Framing field, the DA-30 assumes the AMI Line Code regardless of the setting in this field.

T1.4.1.8. Channel Type

The Channel Type field allows you to choose which type of channel the Interface is accessing. This selection applies to data channels only.

- 56 kpbs — the channel(s) is (are) 56 kbps
- 64 kpbs — the channel(s) is (are) 64 kpbs (Clear Channel Capability)
- FDL — the Facility Data Link is accessed

The 64 kpbs channel type (Clear Channel Capability) is the default. Different channel types may be selected for the two connections on the Receive side. If the DA-30 is emulating, the channel type used by the Transmitter is determined by the option chosen on the "To" receiver.

T1.4.1.9. Voice Channel — Receive Side

This field determines which of the 24 DS0 time slots is used by the handset for receiving. Valid entries are 1 to 24. Only one channel may be specified, but different channels may be selected for the two receivers. The channel selections may also be changed during Run Mode.

T1.4.1.10. Data Channels — Receive Side

This field determines which of the 24 DS0 time slots is accessed by the T1 Interface for data analysis. Single or multiple channels may be specified. Multiple channels may be either contiguous (e.g. channels 4, 5, 6 and 7) or non-contiguous (e.g. channels 9, 14 and 17). Selections are entered in this field using numbers, commas and dashes, according to the following convention:

4	Time Slot 4 is selected
1,2,3	Time Slots 1, 2 and 3 are selected
5,8,12	Time Slots 5, 8 and 12 are selected
1-4	Contiguous Time Slots 1 to 4 inclusive are selected
1--4	Non-contiguous Time Slots from 1 to 4 which are odd-numbered (i.e. 1 and 3) are selected
2--6	Non-contiguous Time Slots from 2 to 6 which are even-numbered (i.e. 2, 4 and 6) are selected

Note:

If you are using the T1 Line Interface Module with WAN Feature Module BN 9305/00.07, only a total of four channels should be selected, to conform with the bandwidth limitation of 256 kpbs. This is a limitation of the WAN Feature Module, not of the T1 Line Interface Module. Channels totalling more than 256 kbps may be selected if line utilization is low, or if the T1 Interface is used with WAN Feature Module BN 9305/00.17 (also called "High Speed WAN").

Different channels may be selected in the two Receive side columns. For example, in Monitor mode it is possible to receive from the CPE on Channels 4, 6 and 8 and from the NET on Channels 10 and 11. Which channels you select is determined by the nature of your application.

T1.4.1.11. Tx Clock

This field determines the source of the Transmit Clock when the DA-30 is emulating. Selections include INTERNAL and LOOP TIMED. A default value is inserted into this field by the choice of Test Function, however, your particular application may require you to alter the default value.

- INTERNAL — the DA-30 provides the Transmit Clock. This is the appropriate choice for either Originate Test Function.
- LOOP TIMED — the Transmit Clock is derived from the clock on the incoming line side, so that the signal timing of generated frames is precisely aligned with timing on the line. This choice can be used with either Originate Test Function, and is required for Drop & Insert testing.

Note:

If you choose to alter the default value, it is possible to select an invalid configuration, or one that is disruptive to data on the circuit. Great care should be taken in selecting clock source values other than the defaults.

T1.4.1.12. Line Build Out

This field allows you to select a Line Build Out level appropriate to the characteristics of the transmission line. The default value is 0 dB, which is equivalent to 0 to 133 feet. Lower amplification levels may be selected, which is usually appropriate when transmitting towards a Channel Service Unit (CSU). More gain may be added when appropriate, for instance, when transmitting towards a Digital Cross-Connect which may be some distance away. Positive Build Out levels are expressed as ranges of feet. Press F1 to view the options, and select the level appropriate to your transmission equipment.

T1.4.1.13. Idle Character

This field selects the character inserted onto an idle line when emulating in either the TX ORIG NET or TX ORIG CPE Test Function. Valid entries are #00 through #FF, with #FF being the default.

T1.4.1.14. Voice Channel — Transmit Side

This field determines which of the 24 DS0 time slots is used by the handset for transmitting. Valid entries are 1 to 24. Only one channel may be specified, which can be different than the channels on which the handset is receiving. The voice transmit channel selection can also be changed during Run Mode.

T1.4.1.15. Data Channels — Transmit Side

This field determines which of the 24 DS0 time slots is used by the T1 Interface for transmission. Single or multiple channels can be specified. Multiple channels may be either contiguous (e.g. channels 4, 5, 6 and 7) or non-contiguous (e.g. channels 9, 14 and 17). Selections are entered in this field using numbers, commas and dashes, according to the following convention:

4	Time Slot 4 is selected
1,2,3	Time Slots 1, 2 and 3 are selected
5,8,12	Time Slots 5, 8 and 12 are selected
1-4	Contiguous Time Slots 1 to 4 inclusive are selected
1--4	Non-contiguous Time Slots from 1 to 4 which are odd-numbered (i.e. 1 and 3) are selected
2--6	Non-contiguous Time Slots from 2 to 6 which are even-numbered (i.e. 2, 4 and 6) are selected

Data channels used for transmitting correlate to those on the Receive side according to the selected Test Function.

RECEIVE ONLY — No transmission is allowed

TX ORIG NET — Data channels selected for the Transmit (To CPE) are viewed by the receiver labelled as To CPE. Channel selection should be the same in these two fields.

TX ORIG CPE — Data channels selected for the Transmit (To NET) are viewed by the receiver labelled as To NET. Channel selection should be the same in these two fields.

TX D&I NET — Data channels selected for Transmit (To CPE) may be different than those in the Receive side columns. The channel designated in the Transmit column is dropped from the From NET line side and replaced by the DA-30, regardless of which channels are selected for the From NET receiver. This allows you to view channels other than that which is inserted, if this is appropriate to your application. If you choose to receive the same channel as you transmit on, the LED displays and T1 Errors counters in Run Mode reflect the condition of the total T1 pipe, but the data-specific displays reflect the condition of the inserted channel(s).

TX D&I CPE — Data channels selected for Transmit (To NET) may be different than those in the Receive side columns. The channel designated in the Transmit column is dropped from the From CPE line side and replaced by the DA-30, regardless of which channels are selected for the From CPE receiver. This allows you to view channels other than that which is inserted, if this is appropriate to your application. If you choose to receive the same channel as you

transmit on, the LED displays and T1 Errors counters in Run Mode reflect the condition of the total T1 pipe, but the data-specific displays reflect the condition of the inserted channel(s).

Note:

If you are using the T1 Line Interface Module with WAN Feature Module BN 9305/00.07, only a total of four channels should be selected for transmission, to conform with the bandwidth limitation of 256 kpbs. This is a limitation of the WAN Feature Module, not of the T1 Line Interface Module. Channels totalling more than 256 kbps may be selected if line utilization is low or if the T1 Interface is used with WAN Feature Module BN 9305/00.17 (also called "High Speed WAN").

T1.4.2. Data Channel Setup

Parameters which are specific to the DA-30's treatment of data from the T1 are configured through the Data Channel Setup menu. You access this menu by moving the cursor to the Data Channel Setup field on the top-level T1 menu, and pressing F2. Data Channel parameters are the same for data from both receivers and transmitted data; it is not possible to configure these parameters relative to the line side. The sub-menu is explained in detail below.

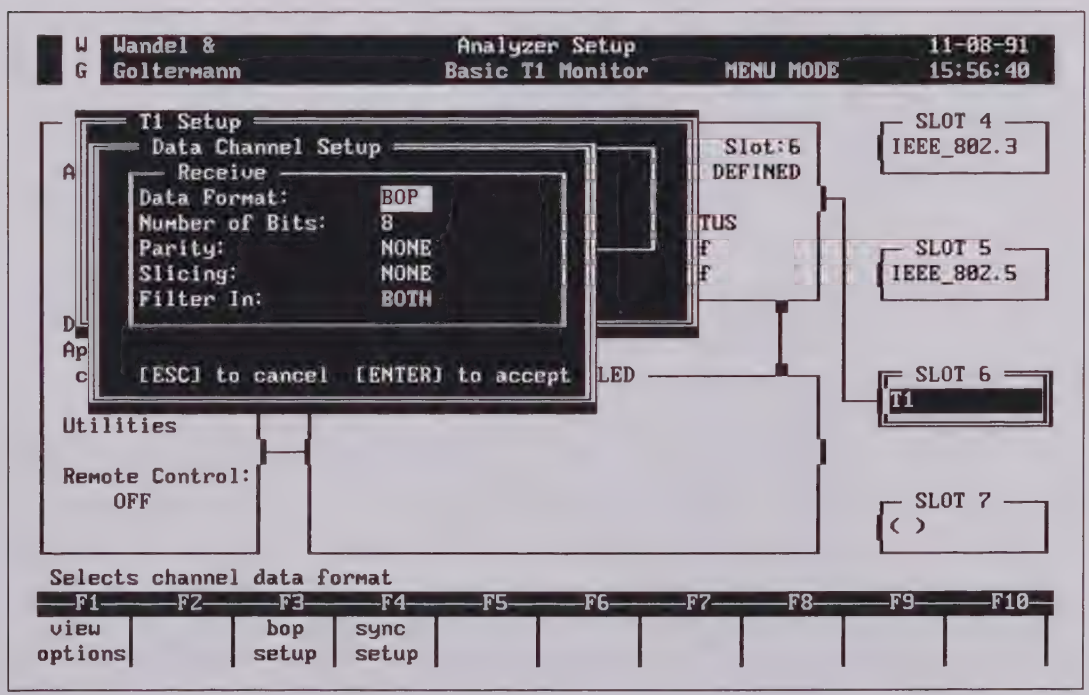


Figure T1-14 T1 Data Channel Setup Menu

T1.4.2.1. Data Format

This field is used to select, and reach further configuration options for, the data format of the channel(s) being accessed. Choices are BOP and SYNC.

- BOP — Data devices are using Bit-Oriented Synchronous Protocols.
- SYNC — Data devices are using Character-Oriented Synchronous Protocols.

Configuration options for BOP and SYNC are accessed through separate sub-menus which develop in a downward-branching tree from the Data Channel Setup menu. To assist you in finding the path through the sub-menus, refer to the following diagram.

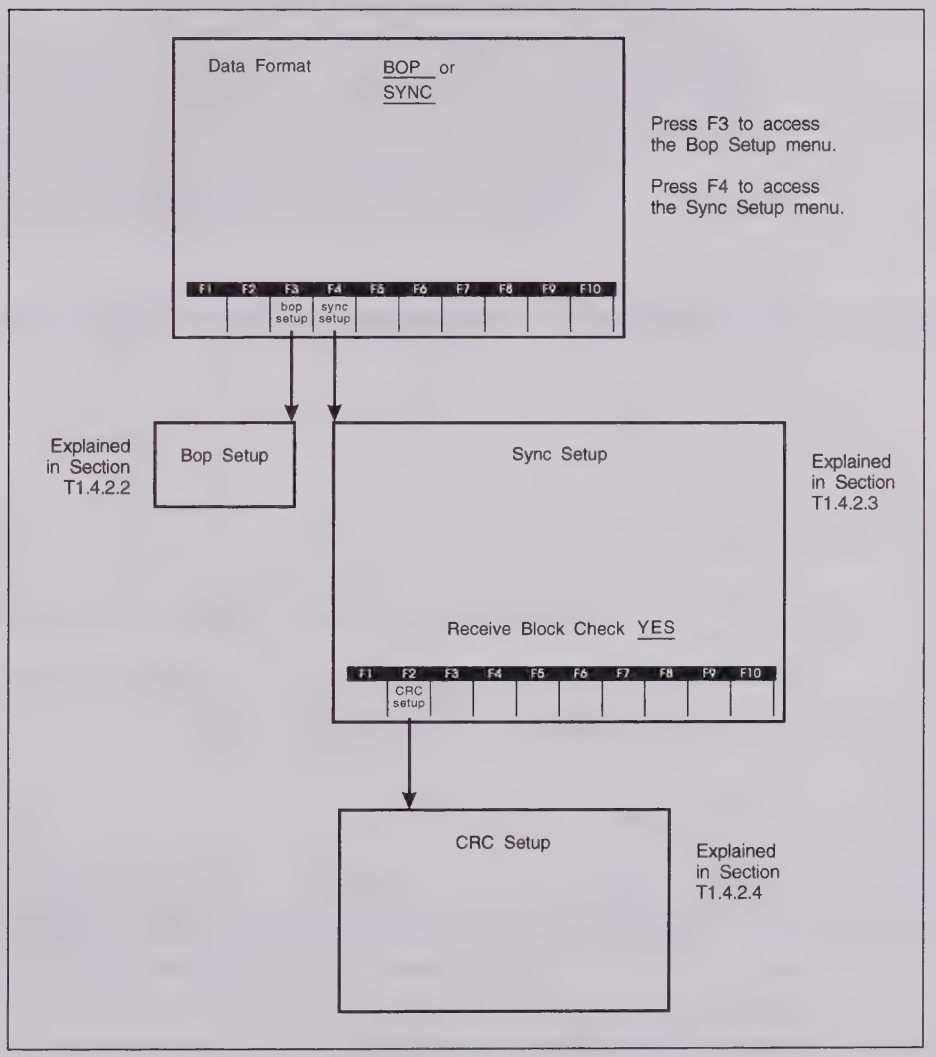

Data Format
BOP or
SYNC
Press F3 to access the Bop Setup menu.
Press F4 to access the Sync Setup menu.
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
bop setup
sync setup
Explained in Section T1.4.2.2
Bop Setup
Sync Setup
Explained in Section T1.4.2.3
Receive Block Check YES
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
CRC setup
CRC Setup
Explained in Section T1.4.2.4

Figure T1-15 Data Format Menu Tree

Explanation of the remainder of the Data Channel Setup menu continues with the Number of Bits field in Section T1.4.2.5.

T1.4.2.2. Bop Setup

Press F3 (bop setup) from the Data Format field if you need to alter the default Bop Setup.

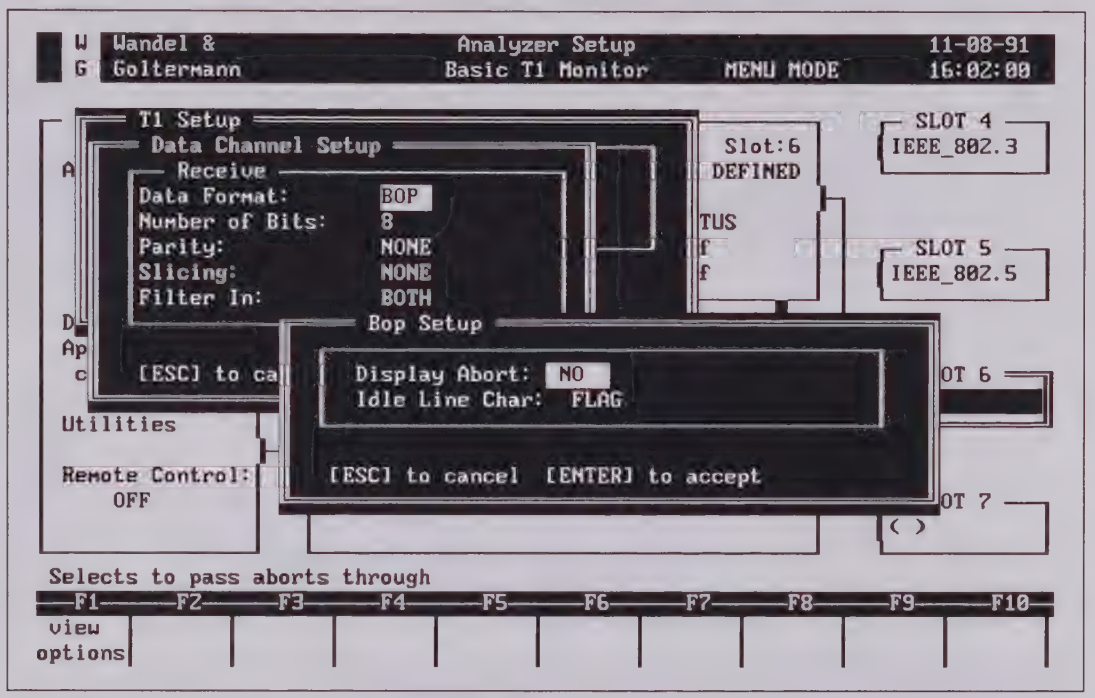


Figure T1-16 Bop Setup for Data Channel

T1.4.2.2.1. Display Abort

This field allows you to select whether aborted frames trigger a specific event in the Network Event Program.

- NO — Aborted frames do not trigger an event in the NEP (default selection).
- YES — Aborted frames do trigger an event in the NEP.

T1.4.2.2.2. Idle Line Character

This field determines what the DA-30 interprets as the Idle Line Character.

- FLAG — the DA-30 interprets FLAG (Hex 7E) as an Idle Line Character.
- MARK — the DA-30 interprets MARK (Hex FF) as an Idle Line Character.

The default Idle Line Character is FLAG.

T1.4.2.3. Sync Setup

Press F4 (sync setup) from the Data Format field if you need to alter the default Sync Setup.

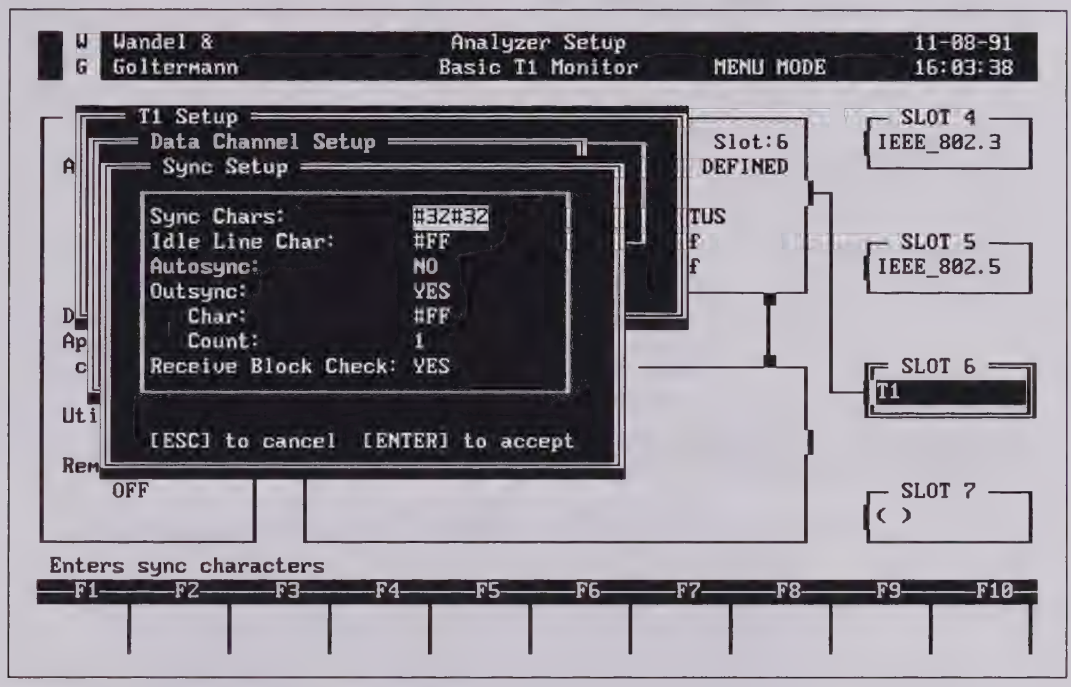


Figure T1-17 Sync Setup for Data Channel

T1.4.2.3.1. Sync Characters

This value in this field determines which characters are used by the DA-30's receiver to synchronize itself with the data line. The format is:

#xx#xx	where:	# represents the use of hexadecimal xx represents the character value

The default Sync Characters are #32#32.

T1.4.2.3.2. Idle Line Character

This field allows you to specify what data character is sent over the line as an Idle Line Character. This is a separate function from the T1 Idle Character. This field is used only when the DA-30 is emulating. The format is:

#xx	where:	# represents the use of hexadecimal xx represents the character value

The default Idle Line Character is #FF.

T1.4.2.3.3. Autosync

The value in this field determines whether or not the receivers resynchronize every time the sync pattern is detected.

- NO — The sync pattern causes resynchronization only if the receivers are out of sync
- YES — Every occurrence of the sync pattern causes resynchronization

The default value for Autosync is NO.

T1.4.2.3.4. Outsync

The Outsync field determines whether or not the receivers go out of sync when the Outsync character pattern is received for the number of times specified in the Count field.

- NO — The receivers do not go out of sync when the Outsync character is seen.
- YES — The receivers go out of sync when the Outsync character is detected.

The default value for Outsync is YES.

T1.4.2.3.5. Outsync Character

The value in this field determines which character is interpreted by the DA-30 as the Outsync character. Enter the character in the field. The format is:

#xx where: # represents the use of hexadecimal
xx represents the character value

The default Outsync Character is #FF.

T1.4.2.3.6. Outsync Count

The Outsync Count field determines the number of consecutive Outsync Characters which must occur for the Outsync condition to take effect. The range is 1 -199. The default Outsync Count is 1.

T1.4.2.3.7. Receive Block Check

The selection in this field determines if the CRC (Cyclic Redundancy Checksum) is performed.

- NO — No CRC checking is performed by the receivers. The only condition that causes a frame to end is when the Outsync condition takes effect.
- YES — The receivers perform CRC checking according to the CRC Setup Menu.

The default value for Receive Block Check is YES. While the cursor is at this field, you may press F2 to access the CRC Setup Menu, explained in Section T1.4.2.4, if you need to alter the default CRC Setup. Otherwise, press Enter or Escape once to return to the Data Channel Setup menu.

T1.4.2.4. CRC Setup

The CRC Setup menu configures the universal CRC calculator for the data within the frame. The menu is shown in Figure T1-18. Settings in this menu do not affect the CRC calculation performed by the T1 equipment. The CRC calculator has a Start state (from which it begins the calculation) and an Accumulate state (where it performs the calculation according to the specified polynomial). Calculation begins when the calculator sees a Start character, which can either be included or not included in the total calculation. The calculation terminates, and the evaluation is returned to the DA-30's display, when an End character is received. Like the Start Character, the End Character can be included or not included in the calculation. When the End Character is received, the calculator can either return to the Start state or complete the calculation and remain in the Accumulate state. Menu settings relative to these options should correspond to the settings used by the terminal equipment which generates the CRC. The default setup is a Bisync CRC check with #01#02 as Start Not Include characters and #03#26 as End Include characters. Other field selections are usually blank. Different CRC calculations may be specified with the following field selections.

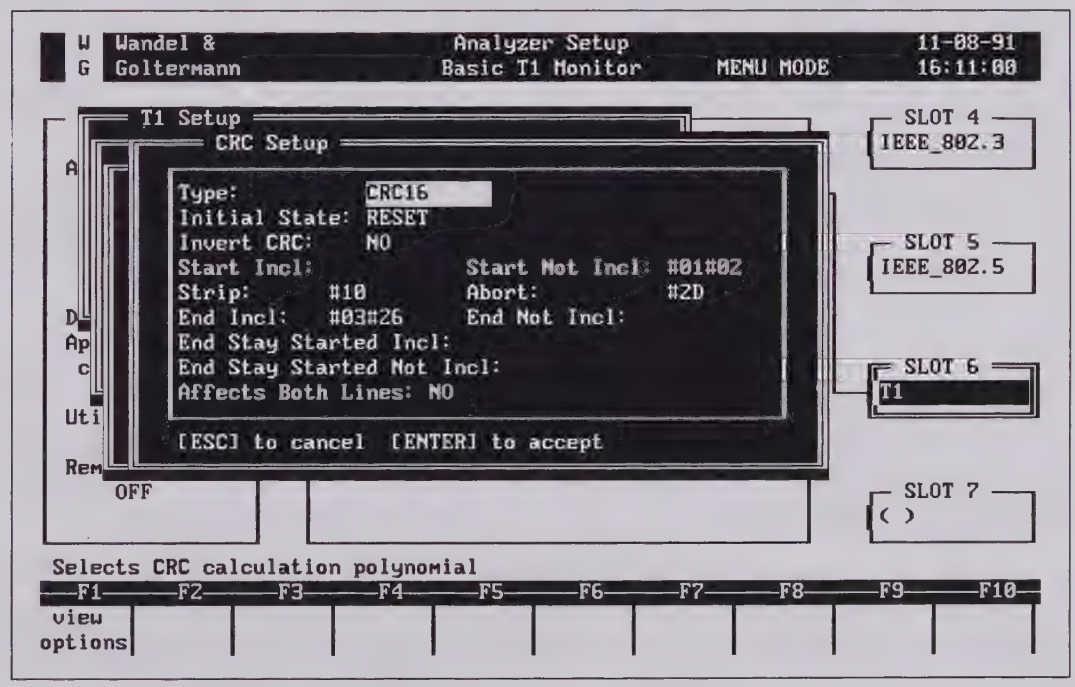


Figure T1-18 CRC Setup Menu

T1.4.2.4.1. Type

The Type field selects the polynomial used during the CRC calculation.

- CRC6 — calculates the CRC by the CRC6 polynomial $x^6 + x^5 + 1$.
- CRC12 — calculates the CRC by the CRC12 polynomial $x^{12} + x^{11} + x^3 + x^2 + x + 1$.
- CRC16 — calculates the CRC by the CRC16 polynomial $x^{16} + x^{15} + x^2 + 1$.
- CCITT — calculates the CRC by the CCITT polynomial $x^{16} + x^{12} + x^5 + 1$.

The default type is CRC16.

T1.4.2.4.2. Initial State

This field determines the initial state of the CRC.

- RESET — the CRC is initially set to all zeros
- PRESET — the CRC is initially set to all ones.

The default initial state is RESET.

T1.4.2.4.3. Invert CRC

The Invert CRC field selects the handling of the CRC during processing.

- NO — leaves the CRC unchanged.
- YES — the entire CRC is inverted. All ones become zeros; all zeros, ones.

The default value is NO.

T1.4.2.4.4. Start Incl

Characters entered in this field trigger the CRC calculation to begin, when one or the other occurs in the data stream. The triggering character seen in the data stream is then included in the CRC calculation. You may enter one or two characters in this field, in the following hexadecimal format:

#xx#xx where: # represents the use of hexadecimal
xx represents the character value

Characters entered in this field should be different than characters in the Start Not Incl field.

T1.4.2.4.5. Start Not Incl

Characters entered in this field trigger the CRC calculation to begin, when one or the other occurs in the data stream. The triggering character is not included in the CRC calculation. You may enter one or two characters in this field, using the following hexadecimal format:

#xx#xx where: # represents the use of hexadecimal
xx represents the character value

The default CRC calculator is a Start Not Include, with characters #01#02 as the start characters. If characters are also present in the Start Incl field, they should be different.

T1.4.2.4.6. Strip

This field allows you to enter characters which should be excluded from the CRC calculation. Enter the Strip characters in hexadecimal, using the following format:

#xx where: # represents the use of hexadecimal
xx represents the character value

The default Strip character is #10.

T1.4.2.4.7. Abort

Characters entered in this field determine which characters in the data stream are interpreted as an Abort. Receipt of an Abort causes the current frame to be flagged as an aborted frame, and terminates the current CRC calculation. The CRC calculator returns to the Start state. Enter the Abort characters in hexadecimal, using the following format:

#xx where: # represents the use of hexadecimal
xx represents the character value

The default Abort character is #2D.

T1.4.2.4.8. End Incl

Characters entered in this field trigger the CRC calculation to end, when one or the other occurs in the data stream. This character is then included in the CRC calculation. Following receipt of one of these characters, the CRC is evaluated as good or bad, and the calculator returns to the Start state. You may enter one or two characters in this field using the following hexadecimal format:

#xx#xx where: # represents the use of hexadecimal
xx represents the character value

The default CRC calculator is an End Include, with characters #03#26 as the end characters (either one or the other). If characters are also present in the End Not Incl, End Stay Started and End Stay Started Not Include fields, they should be different.

T1.4.2.4.9. End Not Incl

Characters entered in this field trigger the CRC calculation to end, when one or the other occurs in the data stream. The received character is not included in the CRC calculation. Following the receipt of one of these characters, the CRC is evaluated as good or bad, and the calculator returns to the Start state. You may enter one or two characters in this field in hexadecimal, using the following format:

#xx#xx where: # represents the use of hexadecimal
xx represents the character value

Characters entered in this field should be different than characters in any of the other fields which pertain to ending the calculation.

T1.4.2.4.10. End Stay Started Incl

Characters entered in this field trigger the CRC calculation to end, when one or the other occurs in the data stream. The triggering character is included in the CRC calculation. Following the receipt of one of these characters, the CRC is evaluated as good or bad, and the calculator returns to the Accumulate state. You may enter one or two hexadecimal characters in this field, using the following format:

#xx#xx where: # represents the use of hexadecimal
xx represents the character value

Characters entered in this field should be different than characters in any of the other fields which pertain to ending the calculation.

T1.4.2.4.11. End Stay Started Not Incl

Characters entered in this field trigger the CRC calculation to end, when one or the other occurs in the data stream. The received character is not included in the CRC calculation. Following the receipt of one of these characters, the CRC is evaluated as good or bad, and the calculator returns to the Accumulate state. You may enter one or two hexadecimal characters in this field, using the following format:

#xx#xx where: # represents the use of hexadecimal
xx represents the character value

Characters entered in this field should be different than characters in any of the other fields which pertain to ending the calculation.

T1.4.2.4.12. Affects Both Lines

The value in this field selects how an aborting CRC calculation affects the CRC calculator.

- NO — the calculation aborts only the current side of the data line.
- YES — the calculation aborts on both sides of the data line.

The default value is NO.

This is the last field in the CRC Setup menu. To return to the Sync Setup menu, press Enter or Escape once. To return to the Data Channel Setup menu, press Enter or Escape twice.

T1.4.2.5. Number of Bits

This field allows you to select the number of bits used per character. The default value is 8 bits per character.

T1.4.2.6. Parity

The value in this field selects what type of parity is used in the system being tested.

- NONE — the system does not use parity for error checking.
- ODD — the system expects odd parity. The combined data and parity bits should contain an odd number of ones.
- EVEN — the system expects even parity. The combined data and parity bits should contain an even number of ones.

The use of parity for error checking is generally restricted to Asynchronous data communications, which is rarely found in environments using T1 transmission lines. For these occasional instances where frames constructed by Asynchronous terminal equipment are present in the data stream (and the Number of Bits is less than 8), you may enable the DA-30's parity checking mechanism to validate data parity as explained. The default value, however, is NONE.

T1.4.2.7. Slicing

Frame Slicing allows you to shorten the data frame before it is passed to the analyzer for processing. You might want to adjust the frame in this way, if you have no use for the "user data" (the user-generated data contained within the frame), and are only interested in those parts of the frame (generally the frame headers) which are added by specific protocols.

Pressing F1 at the Slicing field shows the options, which include NONE (the default), 32, 64, 128, 256, 512 and 1024 bytes. The slicing operation starts at the beginning of the frame. If you select, for instance, to slice at 128 bytes, all data beyond 128 bytes is discarded before reaching the analyzer. An advantage of slicing is that it allows you to maximize the amount of protocol information written to the capture buffer or to the hard disk through logging. A disadvantage of slicing is that you may inadvertently slice the frame in the middle of a protocol header, which makes that protocol invalid for decoding. Your choices regarding slicing (whether to use it, and how far into the frame to slice) are guided by the nature of your application.

T1.4.2.8. Filter In

The Filter In field determines which side of the data line should be passed to the analyzer for processing. You may physically select a line side for monitoring by connecting only certain Bantum cables (see Section T1.3) . However, if you are receiving both line sides physically and want to restrict the DA-30's analysis of data frames to a specific line side, you may create such a filter with this field.

- BOTH — frames both from the CPE and from the NET are passed to the analyzer.
- FROM CPE — only frames from the CPE (TO CPE IN) are passed to the analyzer.
- FROM NET — only frames from the NET (TO NET IN) are passed to the analyzer.

The default value for this field is BOTH.

T1.4.3. Voice Channel Setup

Parameters which are specific to the use of the voice channel on the T1 Interface Module are configured through the Voice Channel Setup menu. You access this menu by moving the cursor to the Voice Channel Setup field on the top-level T1 menu, and pressing F2. This sub-menu, like the T1 Line Setup menu, is divided into parameters for the receive and transmit sides. The device which translates analog voice signals to a digital form (usually to a single 64 kbps fractional T1 channel) and then back to analog is called a Codec (a contraction of Coder/Decoder). Codecs from two different receive channels and to one transmit channel (which can be different from either receive channel) are configured separately in this menu, which is explained in detail below.

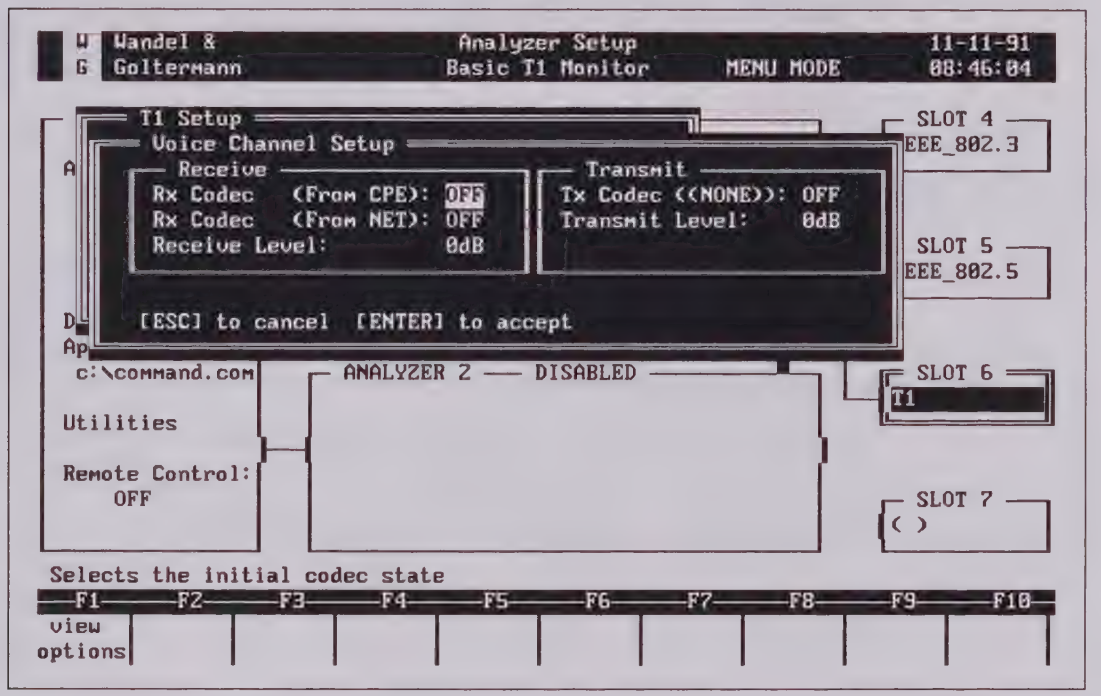


Figure T1-19 T1 Voice Channel Setup Menu

T1.4.3.1. Rx Codec (first)

This field determines the initial state of the first codec. This codec correlates physically to the receiver named in the left-hand Receive side column in the T1 Line Setup (see Section T1.4.1.4), which is determined by the Test Function selected in the same menu. That is, if the Test Function is RECEIVE ONLY, the Receive side column headers are From CPE and From NET, and the first codec is the Voice Channel specified in the From CPE column. If the Test Function is TX ORIG CPE, the Receive side column headers are To NET and From NET, and the first codec is the Voice Channel specified in the To NET column. The T1 channel accessed by this codec is determined by the Channel # selected in the left-hand Receive column, although the channel selection can be changed in Run Mode.

- ON — the codec is on when the DA-30 goes to Run Mode
- OFF — the codec is off when the DA-30 goes to Run Mode

The codec can also be turned ON while in Run Mode, even if it is set as OFF (the default value) initially.

T1.4.3.2. Rx Codec (second)

This field determines the initial state of the second codec. This codec correlates physically to the receiver named in the right-hand Receive side column in the T1 Line Setup (see Section T1.4.1.4), which is determined by the Test Function selected in the same menu. That is, if the Test Function is RECEIVE ONLY, the Receive side column headers are From CPE and From NET, and the second codec is the Voice Channel specified in the From NET column. If the Test Function is TX ORIG NET, the Receive side column headers are From CPE and To CPE, and the second codec is the Voice Channel specified in the To CPE column. The T1 channel accessed by this codec is determined by the Channel # selected in the right-hand Receive column, although the channel selection can be changed in Run Mode.

- ON — the codec is on when the DA-30 goes to Run Mode
- OFF — the codec is off when the DA-30 goes to Run Mode

The codec can also be turned ON while in Run Mode, even if it is set as OFF (the default value) initially.

T1.4.3.3. Receive Level

This field selects the amount of gain or loss added to or subtracted from the signal on the specified Voice Channel relative to a comfortable listening level, which is placed at 0 dB. Selections range from -10 dB to +10 dB, with 0 dB as the default value. If you believe that the received voice signal requires an increase or decrease in volume, you may adjust the Receive Level here. The Receive Level can also be increased or decreased as needed in Run Mode.

T1.4.3.4. Tx Codec

This field determines the initial state of the transmit Codec. The transmission direction of this codec is determined by the Test Function selected in the T1 Setup menu. That is, if the Test Function is TX ORIG NET, the Receive side column headers are From CPE and To CPE and the Transmit side column header is To CPE. If the Test Function is TX D&I CPE, the receive side column headers are From CPE and From NET and the Transmit side column header is To NET. The T1 channel used by the transmit Codec is determined by the Channel # given in the Voice Channel field in the Transmit side of the T1 Setup menu (see Section T1.4.1.4). If the Test Function is RECEIVE ONLY, voice transmission is not enabled.

- ON — the codec is on when the DA-30 goes to Run Mode
- OFF — the codec is off when the DA-30 goes to Run Mode

The codec can also be turned ON while in Run Mode, even if it is set as OFF (the default value) initially.

T1.4.3.5. Transmit Level

This field selects the amount of gain or loss added to or subtracted from the signal on the transmit codec relative to a comfortable listening level, which is placed at 0 dB. Selections range from -10 dB to +10 dB, with 0 dB as the default value. If you believe that the transmitted voice signal requires an increase or decrease in volume, you may adjust the Transmit Level here. The Transmit Level can also be increased or decreased as needed in Run Mode.

T1.4.4. Consistency Check In TESTPREP Mode

After you have completed the T1 Line Setup, press Enter to return to the Main Menu and accept all menu selections. Between Menu Mode and Run Mode, the DA-30 uses TESTPREP Mode to verify that all menu entries are consistent. If you have inadvertantly created an inconsistent setup in the T1 Interface (for instance, you have specified ESFz for framing, but the Line Code field is set for B8ZS), TESTPREP flags the problem. A message appears offering you the option to return to Menu Mode to correct the inconsistency, or allowing the DA-30 to change the inconsistent setting for you. If you choose the latter, the change takes effect in Run Mode only; that is, the menu selection is not physically altered. Running the application again without making the necessary correction in the setup menu produces the same results. If you see a message of this kind when running an application, you may wish to return to Menu Mode, correct the inconsistency and save the application before running again.

T1.5. T1 LED Indicators

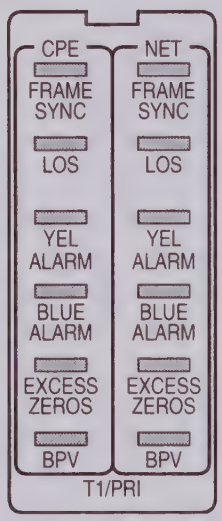


Figure T1-20 T1 LED Overlay

The DA-30 uses its T1 interface-specific LEDs to report network conditions and alarms. The left and right banks of LEDs report individually on the CPE and NET sides of the line; refer to Figure T1-5, if this relationship is not clear to you. During RECEIVE ONLY operation (both connectors bridged), signals to the TO CPE IN Bantum connector (or receive pair on the TO CPE RJ48C connector) are displayed on the left bank of LEDs, which is labelled CPE. Signals to the TO NET IN Bantum connector (or receive pair on the TO NET RJ48C connector) are displayed on the right bank of LEDs, which is labelled NET.

If the DA-30 is performing an ORIGINATE form of emulation (e.g. TX ORIG NET or TX ORIG CPE), one of the IN line sides is terminated and replaced by data generated by the DA-30. In this case, the LEDs reflect the conditions created by the transmitter.

If the DA-30 is in a DROP & INSERT mode, the signals from both T1 sides are still received and evaluated, prior to the DA-30 action of dropping one or more channels from a side. In these cases, the LEDs reflect the activity on the Receive sides, not the conditions created by the DA-30 transmitter.

Conditions for individual LEDs are explained below. Operation, with regard to color or pattern, is the same for both line sides.

FRAME SYNC — green indicates that the Receive side is operating in frame. A red LED indicates that the receiver is out of frame, which occurs if two out of four consecutive framing bits have been in error during a 3 millisecond period. When the receiver goes out of frame, it intiates a reframe action. The LED resets to green when in-frame operation is restored.

LOS — green indicates that a normal T1 signal is received. A red LED indicates that the received signal has been low for 150 ± 50 clock cycles, meaning that the T1 line signal has been lost. The LED resets to green when the Loss of Signal condition clears, which occurs within 6 milliseconds of receiving a logical one on the line.

YEL ALARM — the LED is initially off. If a Yellow Alarm occurs on the Receive side, the LED is red for the duration of the alarm. After the alarm subsides, the LED displays green, to indicate that the alarm has occurred, but is no longer occurring. This is considered an LED History. The LED History can be cleared by pressing the CLR LED HISTORY softkey in Run Mode, which turns the LED off.

BLUE ALARM — the LED is initially off. If a Blue Alarm (an all-ones condition transmitted to the far end of the carrier) occurs on the Receive side, the LED is red for the duration of the alarm. After the alarm ceases, the LED changes to green, to indicate that the alarm has occurred, but is no longer occurring. This is considered an LED History. The LED History can be cleared by pressing the CLR LED HISTORY softkey in Run Mode, which turns the LED off. A Blue Alarm (also called an AIS or Alarm Indication Signal) can also be started and stopped from softkey-driven commands in Run Mode, when one of the Emulate modes is selected in the T1 Line Setup menu. In this case, the LEDs operate the same as they do when the alarm comes from an external source.

EXCESS ZEROS— the LED is initially off. Either of these two conditions can trigger it on:

- 15 or more consecutive zeros occur in the T1 bit stream
- the average one's density falls below 12.5%

In either case, the LED for the affected Receive side is red for the duration of the alarm. When the condition creating the alarm clears, the LED displays green, to indicate that the alarm has occurred, but is no longer occurring. This is how the DA-30 preserves the LED History. The LED History can be cleared by pressing the CLR LED HISTORY softkey in Run Mode, which turns the LED off.

Note:

the presence of signals from other T1 test equipment on the line may cause false readings of excess zeros.

BPV — the LED is initially off. If a Bipolar Violation occurs on the Receive side, the LED is red for the duration of the alarm. After the Bipolar Violations cease, the LED changes to green, to indicate that a BPV has occurred, but is no longer occurring. This shows an LED History. The LED History can be cleared by pressing the CLR LED HISTORY softkey in Run Mode, which turns the LED off. If the B8ZS Line Code is in use, the LED responds only to the actual Bipolar Violations, not to those deliberately inserted by the terminal equipment.

T1.6. T1 Run Mode Capabilities

The DA-30's T1 Run Mode capabilities are available through three Network Status displays, the T1 Summary, T1 Detail and Voice Summary screens. These differ from other DA-30 Interface-specific Network Status screens in both format and number. The T1 Run Mode also supports the execution of certain commands, other than a changing of display, sent directly from the softkey rack to the interface. For instance, the use of a single fractional T1 channel for voice monitoring or transmission can be enabled or disabled, the channel used for this purpose can be changed, and the volume of the signal increased or decreased. Each screen shows an Elapsed Time counter. Additional Run Mode capabilities can be created through the use of a Network Event Program. The individual Network Status displays and softkey-executable commands are reached by pressing F1 (network status) from the Run Mode Top Rack. These capabilities are explained in detail in the following sections.

T1.6.1. The T1 Summary Screen

A typical T1 Summary Screen is shown in Figure T1-21. The screen header shows which Test Function is currently in effect, as well as the number of bits per character, parity (if any) and data format (bit-oriented or sync) selected in the Data Channel Setup menu. The display is sub-divided into sections detailing the Receiver Activity, Transmitter Activity, Errors and the T1 Summary.

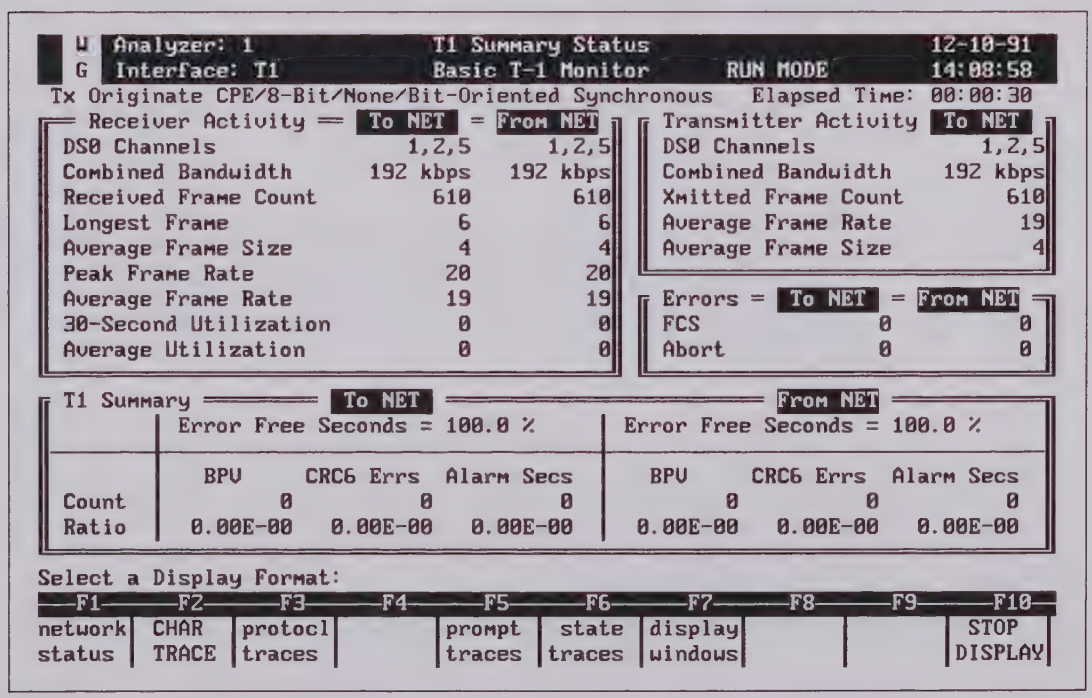

W Analyzer: 1 T1 Summary Status 12-10-91
G Interface: T1 Basic T-1 Monitor RUN MODE 14:08:58
Tx Originate CPE/8-Bit/None/Bit-Oriented Synchronous Elapsed Time: 00:00:30
Receiver Activity = To NET = From NET
DS0 Channels 1,2,5 1,2,5
Combined Bandwidth 192 kbps 192 kbps
Received Frame Count 610 610
Longest Frame 6 6
Average Frame Size 4 4
Peak Frame Rate 20 20
Average Frame Rate 19 19
30-Second Utilization 0 0
Average Utilization 0 0
Transmitter Activity To NET
DS0 Channels 1,2,5
Combined Bandwidth 192 kbps
Xmitted Frame Count 610
Average Frame Rate 19
Average Frame Size 4
Errors = To NET = From NET
FCS 0 0
Abort 0 0
T1 Summary To NET From NET
Error Free Seconds = 100.0 % Error Free Seconds = 100.0 %
BPV CRC6 Errs Alarm Secs BPV CRC6 Errs Alarm Secs
Count 0 0 0 0 0 0
Ratio 0.00E-00 0.00E-00 0.00E-00 0.00E-00 0.00E-00 0.00E-00
Select a Display Format:
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
network status
CHAR TRACE
protocl traces
prompt traces
state traces
display windows
STOP DISPLAY

Figure T1-21 T1 Summary Screen

T1.6.1.1. Receiver Activity

The Receiver Activity portion of the display provides information on the two receivers. The particular receivers viewed are dependent on the Test Function selected in the T1 Line Setup menu. The Receive sides here, and throughout the Network Status screens, correspond to those shown in that menu. For instance, if RECEIVE ONLY is selected as Test Function, the Receive sides are From CPE (physically the TO CPE IN connection) and From NET (the TO

NET IN connection). If the Test Function is TX ORIG NET, the Receive Sides are From CPE (the physical connection being TO CPE IN) and To CPE (the signals generated to the TO CPE OUT connector by the DA-30's transmitter). Refer to Section T1.4.1.4, if these associations and connections are not clear to you. If the Test Function selected is either of the Drop & Insert options, the signals from both T1 sides are received and evaluated, prior to the DA-30 action of dropping one or more channels from a side. In these cases, measurements and statistics about the T1 signal come from the receiver (pre-dropped), but the statistics pertaining to data reflect conditions created by the DA-30 transmitter.

For each receiver, the Receiver Activity portion displays:

- DS0 Channels monitored
- Combined Bandwidth of the channels specified

Information shown in the following counters is specific to the DS0 channels monitored (i.e. not to all data in the total T1 pipe):

- Received Frame Count
- The length of the Longest Frame, in Bytes
- Average Frame Size (Bytes)
- Peak Frame Rate, shown in Frames per second
- Average Frame Rate (Frames per second)
- 30 Second Utilization (% of maximum bits per thirty seconds)
- Average Utilization (% of maximum bits per second)

T1.6.1.2. Transmitter Activity

The Transmitter Activity portion of the T1 Summary Status provides information about the DA-30's transmitter, if enabled. The transmitter follows the Test Function, as specified in the T1 Line Setup menu. For instance, if the Test Function is RECEIVE ONLY, Transmitter Activity is NONE. If the Test Function is TX ORIG CPE, the Transmitter Activity is To NET (the physical connection being the TO NET OUT line).

For the transmitter, if enabled, the Transmitter Activity screen portion displays:

- DS0 Channels transmitted-on
- Combined Bandwidth of the channels specified
- Transmitted Frame Count
- Average Frame Rate (Frames per second)
- Average Frame Size (Bytes)

T1.6.1.3. Errors

The Errors portion of the display maintains running counters of data errors in the DS0 channels analyzed by the two receivers. The receivers in this portion of the display are the same as those monitored in the Receiver Activity portion of the screen. Errors monitored include:

- FCS — this counter increments when a Frame Check Sequence error occurs
- Abort — this counter increments when one of two Abort conditions occur, relative to the Data Format:
  - BOP — an Abort occurs if seven consecutive ones occur in the data stream.
  - SYNC — an Abort occurs if the specified Abort Character appears in the data stream when the Block Check is being calculated, or if the receiver goes out of sync, due to the Outsync character pattern being received for the Outsync Count # of times.

T1.6.1.4. T1 Summary

The T1 Summary portion of the display shows error and alarm statistics for the total T1 pipe as seen at the two receivers. As with the Receiver Activity and Errors displays, the receivers shown are determined by the Test Function selected in the T1 Line Setup menu.

For each receiver, the summary shows:

- Error Free Seconds (% of Elapsed Time) — Error Free Seconds are those with no Bipolar Violations, CRC6 Errors (ESF) or Ft/Fs or Ft Errors (SF).

For each of the following measurements, the display gives both a Count and a Ratio. The basis for the ratio calculation is explained with each statistic. Ratios are shown in scientific notation. The display uses the center statistic on each line side for different types of errors, depending on the Framing option selected in the T1 Line Setup menu.

- BPV — the number of Bipolar Violations. If the B8ZS Line Code is in use, only the actual Bipolar Violations are counted, not those deliberately inserted by the terminal equipment.

  Ratio — the ratio is calculated as the total number of Bipolar Violations divided by the total of possible BPVs (# of D4 frames x 193).

- CRC6 Errors (ESF or ESFz only) — the number of CRC6 errors occurring in the T1 signaling.

  Ratio — the ratio is calculated as the total number of CRC6 Errors divided by the total number of Extended Superframes (# of D4 frames/24).

- Ft/Fs or Ft Errors (SF only) — the number of Ft/Fs Errors or Ft Errors occurring in the bit stream. An Ft or Ft/Fs Error is a single instance of a framing bit failing to follow the expected framing pattern, as opposed to the receiver being completely out of frame.

  Ratio — for Ft/Fs Errors the ratio is calculated as the total number of errors divided by the total number of D4 frames. For Ft Errors, the error ratio is calculated by the total number of errors divided by half the total number of D4 frames (# of D4 frames/2).

- Alarm Seconds — the number of seconds during which a Yellow or Blue Alarm has occurred.

  Ratio — the ratio is calculated by combining the number of seconds in which a Yellow or Blue Alarm has occurred, and dividing by the total number of seconds which have elapsed since the DA-30 went into Run Mode or the T1 Statistics were reset.

T1.6.2. The T1 Detail Screen

A typical T1 Detail Screen is shown in Figure T1-22. The screen header shows which type of framing, line code and channel is selected for each of the two receivers, as specified in the T1 Setup menu. If any of these selections were modified when going into Run Mode, the parameter displayed is that chosen in the setup menu. The display is sub-divided into one section detailing errors and alarms which are applicable to all types of framing, and a section which monitors errors specific to T1 systems using ESF. For each measurement, the display provides both a Count and a Ratio. The basis for the ratio calculation is explained with each statistic. Ratios are shown in scientific notation.

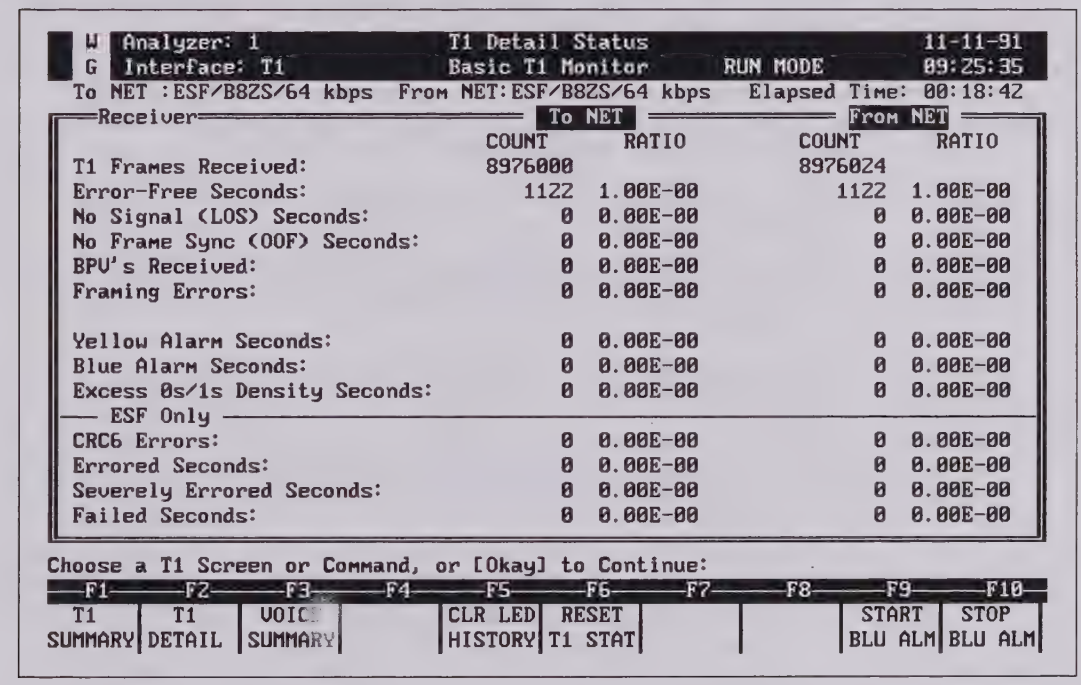

W Analyzer: 1 T1 Detail Status 11-11-91
G Interface: T1 Basic T1 Monitor RUN MODE 09:25:35
To NET :ESF/B8ZS/64 kbps From NET:ESF/B8ZS/64 kbps Elapsed Time: 00:18:42
Receiver
To NET
From NET
COUNT RATIO COUNT RATIO
T1 Frames Received: 8976000 8976024
Error-Free Seconds: 1122 1.00E-00 1122 1.00E-00
No Signal (LOS) Seconds: 0 0.00E-00 0 0.00E-00
No Frame Sync (OOF) Seconds: 0 0.00E-00 0 0.00E-00
BPV's Received: 0 0.00E-00 0 0.00E-00
Framing Errors: 0 0.00E-00 0 0.00E-00
Yellow Alarm Seconds: 0 0.00E-00 0 0.00E-00
Blue Alarm Seconds: 0 0.00E-00 0 0.00E-00
Excess 0s/1s Density Seconds: 0 0.00E-00 0 0.00E-00
ESF Only
CRC6 Errors: 0 0.00E-00 0 0.00E-00
Errored Seconds: 0 0.00E-00 0 0.00E-00
Severely Errored Seconds: 0 0.00E-00 0 0.00E-00
Failed Seconds: 0 0.00E-00 0 0.00E-00
Choose a T1 Screen or Command, or [Okay] to Continue:
F1 T1 SUMMARY
F2 T1 DETAIL
F3 VOIC SUMMARY
F4
F5 CLR LED HISTORY
F6 RESET T1 STAT
F7
F8
F9 START BLU ALM
F10 STOP BLU ALM

Figure T1-22 T-1 Detail Screen

T1.6.2.1. Generic Details (all Framing types)

The following details apply to all Framing types.

- T1 Frames Received (Count only) — the number of D4 frames received.
- Error-Free Seconds — the total number of seconds with no errors.

  Ratio — the ratio is calculated by dividing the Error-Free Seconds by the total number of seconds which have elapsed since the DA-30 went into Run Mode or the T1 Statistics were reset.
- No Signal (LOS) Seconds — the number of seconds that the received signal has been low, meaning that the T1 line signal has been lost.

  Ratio — the ratio is calculated by dividing the No Signal Seconds by the total number of seconds which have elapsed since the DA-30 went into Run Mode or the T1 Statistics were reset.
- No Frame Sync (OOF) Seconds — the number of seconds the receiver has been out of frame, caused by two out of four consecutive framing bits being in error during a 3 millisecond period.

Ratio — the ratio is calculated by dividing the No Frame Sync seconds by the total number of seconds which have elapsed since the DA-30 went into Run Mode or the T1 Statistics were reset.

- BPV's Received — the number of Bipolar Violations received. If the B8ZS Line Code is in use, only the actual Bipolar Violations are counted, not those deliberately inserted by the terminal equipment.

  Ratio — the ratio is calculated as the total number of Bipolar Violations divided by the total of possible BPVs (# of D4 frames x 193).

- Framing Errors — the number of times that framing bits have not followed the expected pattern. The expected pattern varies depending on the type of Framing in use. If SF is chosen, the Framing Errors counted here are the same type (relative to Ft/Fs or Ft only) as shown in the T1 Summary Screen.

  Ratio — the ratio is calculated as the total number of framing errors divided by the number of framing bits in use for the type of Framing selected.

- Yellow Alarm Seconds — the number of seconds during which a Yellow Alarm has occurred.

  Ratio — the ratio is calculated by dividing the number of Yellow Alarm Seconds by the total number of seconds elapsed since the DA-30 went to Run Mode or the T1 Statistics were reset.

- Blue Alarm Seconds — the number of seconds during which a Blue Alarm (or AIS) has occurred.

  Ratio — the ratio is calculated by dividing the number of Blue Alarm Seconds by the total number of seconds elapsed since the DA-30 went to Run Mode or the T1 Statistics were reset.

- Excess 0s/1s Density Seconds — the number of seconds during which there has been an Excess Zeros condition (15 or more consecutive zeros occur in the T1 bit stream) or during which the average one's density falls below 12.5%. This measurement is usually only relevant when the AMI Line Code is in use.

> **Note:**
>
> the presence of signals from other T1 test equipment on the line may cause false readings of excess zeros.

Ratio — the ratio is calculated by dividing the number of seconds during which one of these conditions occurred by the total number of seconds elapsed since the DA-30 went to Run Mode or the T1 Statistics were reset.

T1.6.2.2. ESF Only Details

The following details apply only to ESF. Errors measured and used as the basis for these calculations are drawn from the T1 Interface's error detection circuitry, not from the Facility Data Link.

- CRC6 Errors — the number of CRC6 errors occurring in the T1 signaling.

  Ratio — the ratio is calculated by dividing the total number of CRC6 Errors by the total number of Extended Superframes (# of D4 frames/24).

- Errored Seconds — the number of seconds in which either a CRC6 error has occurred or the receiver has been out of frame. A T1 frame is considered Errored if at least one, but no more than 319, errors of either type occur.

  Ratio — the ratio is calculated by dividing the number of Errored Seconds by the total number of seconds elapsed since the DA-30 went to Run Mode or the T1 Statistics were reset.

- Severely Errored Seconds (also known as SES) — the number of seconds in which at least 320 CRC6 or out of frame errors have occurred.

  Ratio — the ratio is calculated dividing the number of Severely Errored Seconds by the total number of seconds elapsed since the DA-30 went to Run Mode or the T1 Statistics were reset.

- Failed Seconds — the number of seconds which have been preceded by at least ten consecutive Severely Errored Seconds (SES). That is, when ten consecutive Severely Errored Seconds occur, the eleventh SES causes both the Failed Second counter and the Severely Errored Second counter to increment. At least ten consecutive seconds without the Severely Errored condition must pass before the Failed Seconds counter stops incrementing.

  Ratio — the ratio is calculated dividing the number of Failed Seconds by the total number of seconds elapsed since the DA-30 went to Run Mode or the T1 Statistics were reset.

T1.6.3. The Voice Summary Screen

A typical Voice Summary Screen is shown in Figure T1-23. The screen header shows which Test Function is currently in effect, as well as the number of bits per character, parity (if any) and data format (bit-oriented or sync) selected in the Data Channel Setup menu. The display contains an abbreviated form of the T1 Summary Screen sections detailing the Receiver Activity, Transmitter Activity and Errors, as well as the Voice Summary. A special softkey rack, allowing manipulation of the voice channels, is accessible from this screen. You can reach this softkey rack by pressing F7 (voice select) while the Voice Summary Screen is the current display.

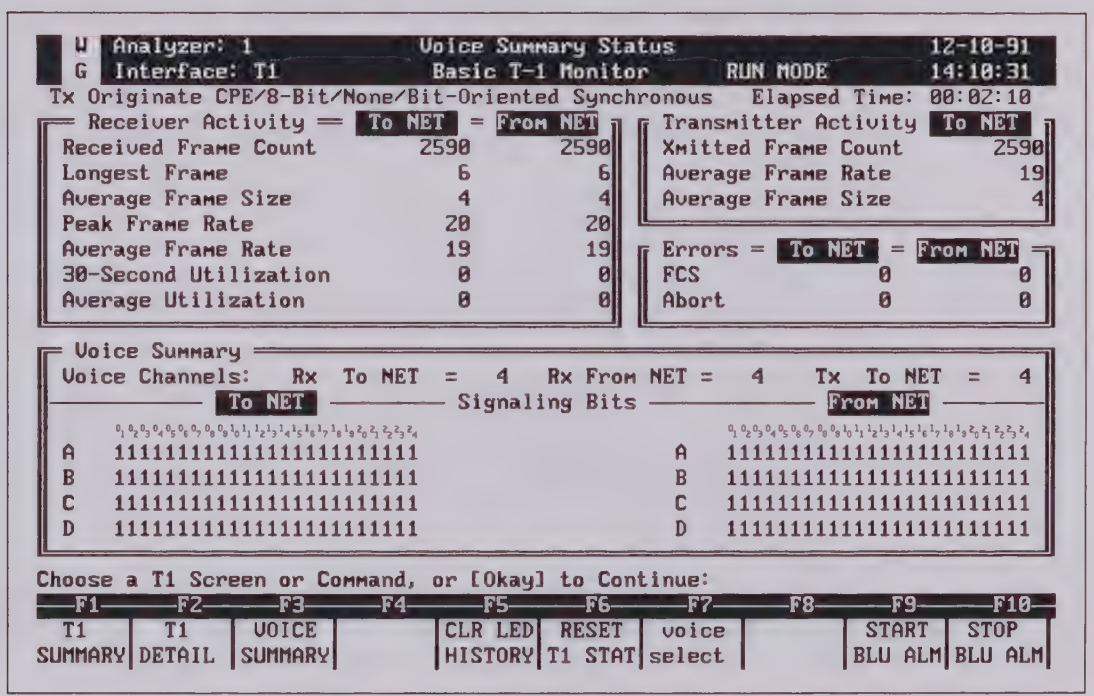

W Analyzer: 1 Voice Summary Status 12-10-91
G Interface: T1 Basic T-1 Monitor RUN MODE 14:10:31
Tx Originate CPE/8-Bit/None/Bit-Oriented Synchronous Elapsed Time: 00:02:10
Receiver Activity = To NET = From NET
Received Frame Count 2590 2590
Longest Frame 6 6
Average Frame Size 4 4
Peak Frame Rate 20 20
Average Frame Rate 19 19
30-Second Utilization 0 0
Average Utilization 0 0
Transmitter Activity To NET
Xmitted Frame Count 2590
Average Frame Rate 19
Average Frame Size 4
Errors = To NET = From NET
FCS 0 0
Abort 0 0
Voice Summary
Voice Channels: Rx To NET = 4 Rx From NET = 4 Tx To NET = 4
To NET Signaling Bits From NET
A 11111111111111111111111
B 11111111111111111111111
C 11111111111111111111111
D 11111111111111111111111
A 11111111111111111111111
B 11111111111111111111111
C 11111111111111111111111
D 11111111111111111111111
Choose a T1 Screen or Command, or [Okay] to Continue:
F1 T1 SUMMARY
F2 T1 DETAIL
F3 VOICE SUMMARY
F4
F5 CLR LED HISTORY
F6 RESET T1 STAT
F7 voice select
F8
F9 START BLU ALM
F10 STOP BLU ALM

Figure T1-23 Voice Summary Screen

T1.6.3.1. Receiver Activity

Here, as in the Receiver Activity portion of the T1 Summary Display, information about the two receivers is displayed. The particular receivers viewed are dependent on the Test Function selected in the T1 Line Setup menu. Refer to Section T1.4.1.4, if these associations and connections are not clear to you. If the Test Function selected is either of the Drop & Insert options, the signals from both T1 sides are received and evaluated, prior to the DA-30 action of dropping one or more channels from a side. In this case, measurements and statistics used in the Network Status screens reflect the activity on the Receive sides, not the conditions created by the DA-30 transmitter.

For each receiver, the Receiver Activity portion displays:

- Received Frame Count
- The length of the Longest Frame, in Bytes
- Average Frame Size (Bytes)
- Peak Frame Rate, shown in Frames per second
- Average Frame Rate (Frames per second)

- 30 Second Utilization (% of maximum bits per thirty seconds)
- Average Utilization (% of maximum bits per second)

T1.6.3.2. Transmitter Activity

The Transmitter Activity portion of the Voice Summary is essentially the same as that in the T1 Summary Status. Again, the particular transmitter monitored follows the Test Function, as specified in the T1 Line Setup menu.

For the transmitter, if enabled, the Transmitter Activity screen portion displays:

- Transmitted Frame Count
- Average Frame Rate (Frames per second)
- Average Frame Size (Bytes)

T1.6.3.3. Errors

Just as in the T1 Summary Screen, the Errors portion of the display maintains running counters of data errors in the DS0 channels analyzed by the two receivers monitored as a result of the choice of Test Function. Errors monitored include:

- FCS — this counter increments when a Frame Check Sequence error occurs
- Abort — this counter increments when one of two Abort conditions occur, relative to the Data Format:
  - BOP — an Abort occurs if seven consecutive ones occur in the data stream.
  - SYNC — an Abort occurs if the specified Abort Character appears in the data stream when the Block Check is being calculated, or if the receiver goes out of sync, due to the Outsync character pattern being received for Outsync Count # of times.

T1.6.3.4. Voice Summary

The Voice Summary portion of the screen shows the condition of the voice channels in use, both transmit and receive, and the status of the signaling bits for the two receivers.

T1.6.3.4.1. Voice Channels

As with data on the T1 circuit, the DA-30 can receive on two voice channels and transmit on one. The Voice Channel indicators show OFF if the use of a channel for voice is not enabled. If the channel is enabled for voice, the channel # is shown.

T1.6.3.4.2. Signaling Bits

When a DS0 channel is used for voice, a bit from that channel in every sixth SF or ESF frame is dedicated to carrying signaling information such as indicators for dialing, idle, busy, on- and off-hook. This process is known as robbed-bit signaling and the repetitive pattern formed with these bits is called a signaling channel. Since each Superframe has twelve D4 frames, two signaling channels are created — one at the sixth and one at the twelfth frame. Extended Superframing and Extended Superframing with ZBTSI each have four signaling channels, created by the using the robbed bits (usually the Least Significant Bit of each channel) at the sixth, twelfth, eighteenth and twenty-fourth frames.

The Signaling Bits display depicts the status of these bits for each DS0 channel, whether it is used for voice transmission or not. The numbers across the top of the display correspond to the DS0 channels. The bit shown is the Least Significant Bit of that DS0 channel within the D4 frame. The letter designations (A and B for SF, and A, B, C and D for ESF and ESFz) correspond to the signaling channels (A corresponds to the sixth D4 frame, B to the twelfth, and so forth). If you are reading the signaling bits relative to your use of a particular channel, read the bits "down" from the channel #. For instance, if you are using Channel 1 for voice, and the framing is SF, you might see A=0 and B=1, which might be interpreted as meaning that the channel is in an off-hook condition.

If the DS0 channel is not being used for voice (i.e. it is used for data, or is idle), the bits shown correspond to their actual values in these positions in the bit stream. In 56 kpbs channels used for data, the bit is often stuffed with ones, to maintain ones-density. In 64 kpbs data channels, the bit-position is used for user data. On an idle channel, the bit is a 1, corresponding to the LSB of a hexadecimal FF, which is the usual T1 Idle Line character.

T1.6.4. T1 Softkey-Generated Commands — Network Status

The DA-30 T1 Interface supports the execution of several interface-specific commands in Run Mode. The first group of commands take action in any T1 Network Status Screen and are generated directly from the softkey rack shown in Figure T1-24. To reach this softkey rack, press F1 (network status) from the Run Mode Top Rack. The functions of these softkey-generated commands are explained in detail below.

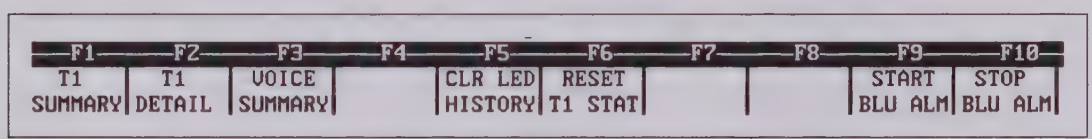


Figure T1-24 T-1 Network Status Softkey Rack

T1.6.4.1. T1 SUMMARY (F1)

Pressing the F1 key accesses the T1 Summary Screen (explained in Section T1.6.1). The T1 Summary Screen is the top-level display of the three T-1 Network Status screens. If the display is already at this screen, pressing F1 has no effect.

T1.6.4.2. T1 DETAIL (F2)

Pressing the F2 key accesses the T1 Detail Screen (explained in Section T1.6.2). The T1 Detail Screen provides many useful statistics about the quality of the T1 circuit under test. If the display is already at this screen, pressing F2 has no effect.

T1.6.4.3. VOICE SUMMARY (F3)

Pressing the F3 key accesses the Voice Summary Screen (explained in Section T1.6.3). The Voice Summary Screen shows the condition of the Voice Channels and the status of the signaling bits. If the display is already at this screen, pressing F3 has no effect.

T1.6.4.4. CLR LED HISTORY (F5)

The F5 key allows you to reset the LEDs which have both an "active" and "history" condition to the off state. These include the Yellow Alarm, Blue Alarm, Excess Zeros and BPV LEDs. For instance, if Bipolar Violations have occurred, but are no longer occurring, the BPV LED transitions from off to red, then to green, to preserve the LED History. Pressing F5 clears the history by turning the LED off.

T1.6.4.5. RESET T1 STAT (F6)

Pressing the F6 key resets all statistical displays relating to the state of the T1 circuit to zero. This includes the T1 Summary statistics on the T1 Summary Screen and all T1 statistics on the T1 Detail Screen. New measurements begin immediately. The total number of seconds, which is used in several statistical ratio calculations, is also reset to zero, although the DA-30's Elapsed Time display is not reset. The data statistics and the Voice Summary displays are not affected.

T1.6.4.6. START BLUE ALARM (F9)

Pressing the F9 key transmits a Blue Alarm (an all-ones condition, also called AIS) onto the carrier from the DA-30 transmitter. The line side affected is dependent on the Test Function of the T1 Interface. For instance, if the Test Function selected is TX ORIG NET, the transmitter is directed To CPE (physically, the TO CPE OUT connector), and the Blue Alarm is sent to this line side. If the Test Function selected is RECEIVE ONLY, the transmitter is disabled and pressing this softkey has no effect.

T1.6.4.7. STOP BLUE ALARM (F10)

Pressing the F10 key stops the transmission of a Blue Alarm onto the carrier from the DA-30 transmitter. If the transmitter is not sending a Blue Alarm, pressing this softkey has no effect.

T1.6.5. T1 Softkey-Generated Commands — Voice Select

A special set of commands which are specific to the use of the T1 Interface for voice support via the RJ-11 handset connector can be accessed when the Voice Summary Network Status Screen is selected. This softkey rack, called Voice Select, is shown in Figure T1-25. To reach it, press F1 (network status) from the Run Mode Top Rack, then F3 (VOICE SUMMARY), followed by F7 (voice select). This softkey rack allows you to do the following:

- choose one of the two available receivers for monitoring use with the handset connection
- enable or disable the receive codec associated with that receiver
- enable or disable the transmit codec
- change the DS0 channels accessed by any codec
- change the receive/transmit volume for any codec

The use of these softkeys is explained in detail below.

Figure T1-25 T-1 Voice Select Softkey Rack

T1.6.5.1. Selecting the Channel (F1, F2, F3)

The handset can access one channel on each of the two receivers. This can be the same channel on both receivers, or two different channels; sounds from the two codecs are mixed equally. As is the case throughout the use of the T1 Interface, the particular receivers available are determined by the Test Function selected in the T1 Line Setup. For instance, if the Test Function selected is RECEIVE ONLY, the two receivers are From CPE and From NET, and you can not transmit your own voice onto the line. The more common uses of the handset and a voice channel involve one of the EMULATE modes, such as TX ORIG NET or TX ORIG CPE. As you may recall, in these functions one of the receivers is dedicated to the transmitter in use. So, if the Test Function is TX ORIG NET, the two receivers are From CPE and To CPE, and what is transmitted on To CPE is also received. If the channel is enabled for voice transmission, this means that you can hear both the speaker at the CPE end of the line (on From CPE) and your own voice being transmitted on To CPE.

Your choice of channels is important, because it is possible to adjust each of the two receivers and the transmitter individually. This provides a great deal of flexibility, but it also means you could inadvertantly cut yourself off from the person you are listening to at the other end of the line, or cut your transmit channel off from your receiver (meaning you are still transmitting, but cannot hear yourself talk). You could also accidentally insert voice onto a channel carrying data.

In the Voice Summary Status Screen, the two receivers and one transmitter are identified above the Signaling Bits (see Figure T1-23). The receivers and transmitter correspond to To/From NET/CPE by means of the Test Function selected. The three softkeys (F1, F2 and F3) correspond to the receivers or transmitter available for updating. One of the three is always ready to be updated with regard to enabling/disabling, channel and volume; this one is not shown on the softkey rack, but is named in the prompt line. You must look at the prompt line (above the softkey rack) to know which receiver or transmitter you are updating. If you wish to update another receiver or transmitter, press the softkey which names it. The softkey rack adjusts so that the receiver/transmitter you selected is no longer shown in the softkey rack, but is named in the prompt line as available for updating. You may now make whatever changes are needed to the codec corresponding to this receiver or transmitter.

T1.6.5.2. Changing the Channel (F5, F6)

You may switch the voice channel receiver or transmitter selected for updating (if enabled) into any of the 24 DS0 time slots using the Channel ↑ (F5) or Channel ↓ (F6) keys. The channel number may also be set initially in the T1 Line Setup menu in Menu Mode. Great care should be taken in changing channels in Run Mode. If the selector taps your voice codec into a time slot already in use for data, the data in that channel is corrupted.

T1.6.5.3. Adjusting the Volume (F7, F8)

You may adjust the volume on the voice channel receive or transmit codec selected for updating (if enabled) by using the Volume ↑ (F7) or Volume ↓ (F8) keys. The volume level may also be set initially in the Voice Channel Setup menu in Menu Mode. The default volume for both transmit and receive is set at 0 dB, which is considered to be a comfortable listening level.

T1.6.5.4. Enabling/Disabling the Codec (F9, F10)

You may enable or disable the receive or transmit codec selected for updating by using the F9 (ON) or F10 (OFF) keys. The codecs may also be set as on or off in the Voice Channel Setup menu in Menu Mode.

T1.7. T1 Examine Mode Capabilities

The DA-30's T1 Examine Mode capabilities consist of the same three Network Status displays that are available in Run Mode. These are the T1 Summary, T1 Detail and Voice Summary screens. These Network Status displays are reached by pressing F1 (network status) from the Examine Mode Top Rack. The statistical information for the T1 circuit and the data found in the selected fractional channels is frozen at the last values measured in Run Mode. If you enter Examine Mode from Run Mode, the T1 interface remains active to the line, performing the same Test Function that it did in Run Mode. T1 framing and signaling continue uninterrupted, however the softkey-generated commands found on the Run Mode Network Status and Voice Summary softkey racks are not available. This means, for instance, that you could continue to use the handset connection to talk on an enabled voice channel in Examine Mode, but you cannot change the channel or adjust the volume. There are no find commands specific to the T1 interface.

T1.8. T1 Interface Technical Specifications

T1.8.1. Network Interface

Framing Modes	D4, ESF, ESFz (ESF with ZBTSI)
Codes	AMI, B8ZS
Data Channel Types	56 kbps, 64 kbps, n × 56 kbps, n × 64 kbps, ESF data link, 1.544 Mbps (unframed)
Test Access Points	DSX-1, DSX-1 Monitor Jack, CSU, Repeater
Termination options	100 Ω Terminated > 1000 Ω Bridged DSX Monitor Jack Termination
Connectors	2 Dual Bantum, 2 RJ-48C, RJ-11(VF)
Connector Pinouts	RJ48 Pin 1 Receive Data (Ring) Pin 2 Receive Data (Tip) Pin 3 Unused Pin 4 Transmit Data (Ring) Pin 5 Transmit Data (Tip) Pin 6 Unused Pin 7 Shield Pin 8 Unused RJ11 Pin 1 Microphone Positive Pin 2 Earphone Negative Pin 3 Earphone Positive Pin 4 Microphone Negative

T1.8.1.1. Receiver Specifications

Receiver Sensitivity	-30dB to 0dB cable attenuation (nonmonitor jack)
Jitter Tolerance	Per mask specs defined in Bellcore TR TSY-000499 (Issue 2, December, 1988).

T1.8.1.2. Transmitter Specifications

Transmit Level	3 Volts nominal; +/-0.3V (at 0 db line buildout)
Transmit Pulse	In full compliance with mask set by Bellcore TR TSY-000499.
Transmit Clocking	Internally generated 1.544MHz (+/-50 ppm) Loop timed from derived receive clock
Transmitter Buildouts	-7.5 dB Buildout -15 dB Buildout 0 dB 0-133 ft (DSX-1 Crossconnect) 133-266 ft (DSX-1 Crossconnect) 266-399 ft (DSX-1 Crossconnect) 399-533 ft (DSX-1 Crossconnect) 533-655 ft (DSX-1 Crossconnect)

T1.8.1.3. Voice Frequency Specifications

Voice Freq Port	Standard carbon mic handset interface with Dual Rx, Single Tx (adjustable gain/attenuation)
Voice Freq. Chan.	1 channel from each side is selectable for simultaneous monitoring via external handset. This selection is independent of the data monitoring channel selection. VF data from the handset may be inserted into 1 channel of the outgoing transmit data, independent of data D & I functions.

T1.8.2. Test Modes

All modes switched by mechanical relays

Receive Only Modes	Thru Mode (bridged receive only) Monitor Mode (either bridged, terminated, or at DSX Monitor Jack)

Two independent receive paths exist. Different channels may be selected for each side of the line.

Emulate Modes	2 TX Originate 2 Drop & Insert

One transmit side exists. Multiple and simultaneous data sources include

1 or more DS0s
Voice Frequency port
User-defined idle byte
Thru data (drop and insert mode)

T1.8.3. Detected Errors

Out of Frame (LED indication)
Loss of Signal (LED indication)
Yellow Alarm (LED indication)
Blue Alarm, AIS (LED indication)
Bipolar Violation (LED and counter)
Ones Density Violation (LED and counter)
CRC Error (counter)
Framing Error (counter)

T1.8.4. Electrical Specifications

Maximum current requirements	@ +5 Volt, 0.80 Amperes
	@ -12 Volt, 0.05 Amperes
	@ +12 Volt, 0.30 Amperes

HST1

High Speed T1 Interface Operation

(Addendum to the T1 Interface Operation Document)

HST1.1. Introduction

The High Speed T1 Interface retains the basic functionality of the standard T1 Interface. However, the High Speed T1 Interface boasts several enhancements over its counterpart that are summed up as follows:

- **Increase in Operating Speed**
  The High Speed T1 Interface operates at full-pipe capability (1544 kbps in UNFRAMED mode) whereas the standard T1 Interface operates at up to 256 kbps.
- **Revised Setup Menus**
  The standard T1 Interface setup menus have been revised and reorganized to produce the ones for the High Speed T1 Interface. The revised menus are clearer and easier to understand. New fields have been added, and some existing fields have been given substantially new functionality.
- **New Network Status Screens (T1 Summary & Voice Summary)**
  The High Speed T1 Network Status screens contain all the original information on the standard T1 screens. However, it provides additional status information.
- **Dropped Bisync and Async Data Framing**
  The High Speed T1 Interface does not support character-oriented protocols (i.e. Bisync) or Asynchronous (Async) data framing. This interface supports only Bit-Oriented Protocols (BOPs).
- **Added "Unframed" To Framing Selection**
  The High Speed T1 supports the Unframed format at full-pipe (1.544 Mbps) speed.

This document is an addendum to the *T1 Interface Operation* document. It identifies the differences between the standard T1 and the High Speed T1 Line Interfaces. This document deals with the differences only (i.e. menu changes, network status screen). The menus and screens for the High Speed T1 are the same as those for standard T1 except where noted in this document. Where changes occur, the corresponding section number (from the T1 Interface Operation document) is referenced and enclosed in parentheses. Any new menus or screens are shown here.

HST1.2. DA-30 High Speed T1 Option (T1.2)

The High Speed T1 Interface derives its basic functionality from the following:

- Line Interface Module (LIM)—circuit board
- High Speed WAN Feature Module
- Line Interface Package (LIP)
- Layer Protocol Package (LPP)

The actual Line Interface Module used for the High Speed T1 Interface is identical to the one used for the standard T1 Interface. The differences in their functionality stem from their corresponding feature modules, LIP software and LPP software.

> **Note:**
>
> Before you can use the High Speed T1 Line Interface, you must also have a Protocol Analyzer Module and a High Speed WAN Feature Module installed.

The T1 Line Interface Module is installed, together with a High Speed WAN Feature Module, in Slots 4 and 5, or Slots 6 and 7, of the DA-30 Mainframe. Refer to the "Installing Hardware Accessories" appendix of the *DA-30/31 Operating Manual* for instructions on how to install these boards.

The Line Interface and Layer Protocol Package software are installed on the DA-30's hard disk. Refer to the "Installing Software" appendix of the *DA-30/31 Operating Manual* for software installation and loading instructions.

HST1.3. Completing the Line Setup (T1.4)

The appearance of the Top-Level Setup menu has been slightly altered. The new menu is shown in Figure HST1-1.

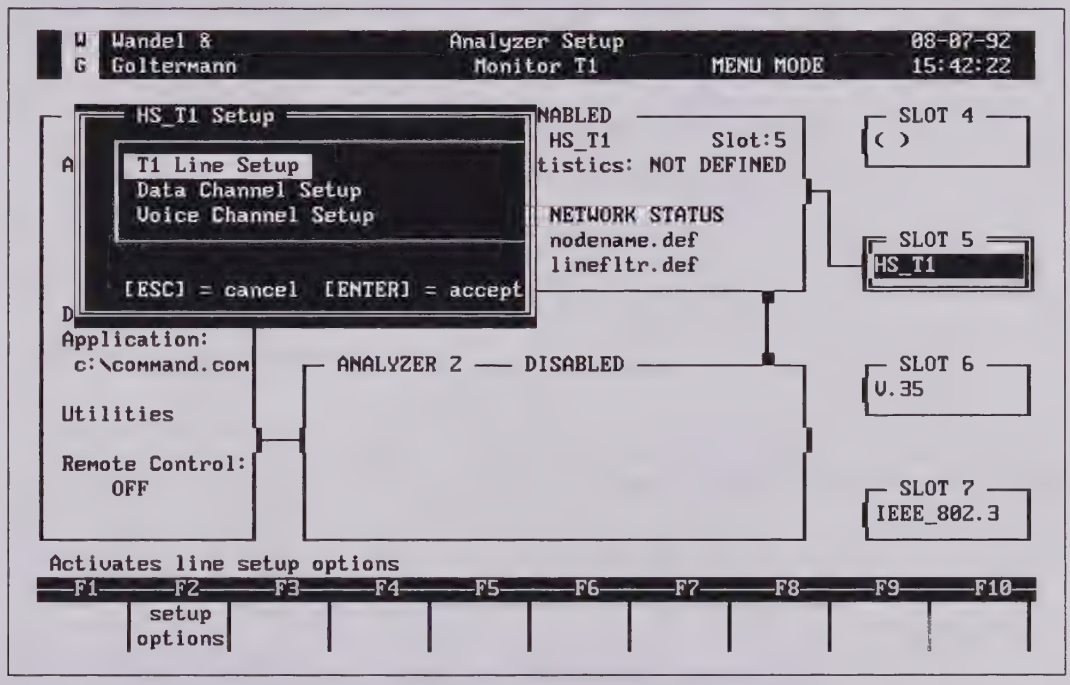


Figure HST1-1 HS_T1 Top-Level Setup Menu

As you can see, this menu is almost identical to the T1 Top-Level Setup Menu (Figure T1-11) for the standard T1 Interface. The only difference is that the menu title has been changed from "T1 Setup" to "HS_T1 Setup."

HST1.3.1. The T1 Line Setup (T1.4.1)

The T1 Line Setup menu is identical to the one described for the standard T1 Interface (Figure T1-12) except for the addition of a selection for the Framing field.

HST1.3.1.1. Framing (T1.4.1.6)

The following selection has been added to the list of framing options:

- UNFRAMED – No framing used. Allows full-pipe T1 at 1.544 Mbps.

> **Note:**
>
> Any values contained in the Voice Channel and Data Channels fields (on the T1 Line Setup menu) are ignored when operating the "UNFRAMED" framing mode.

HST1.3.1.2. Line Code (T1.4.1.7)

The Line Code field offers the same line codes as the standard T1 Interface. However, the line codes now depend on your Framing selection on the T1 Line Setup menu. The appropriate line code is automatically selected based on the Framing selection as shown in Table 1. However, you may override these automatic selections by entering your own line code choice.

Framing	Line Code
ESF	B8ZS
SF (D4)	AMI
ESFz	AMI
UNFRAMED	B8ZS

Table 1 Line Code Automatic Selection

HST1.3.2. Data Channel Setup (T1.4.2)

The Data Channel Setup menu has changed substantially from the one described for the standard T1 Interface (Figure T1-14). Fields have been both added and deleted. Field names have been modified. The new menu is shown in Figure HST1-2.

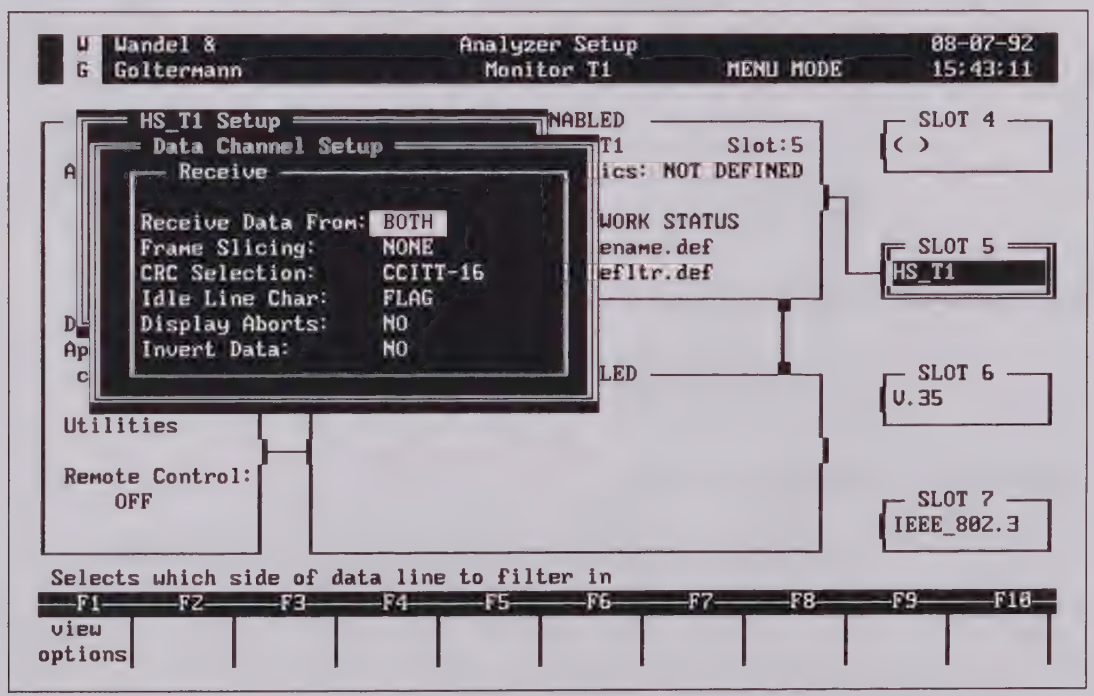


Figure HST1-2 HS_T1 Data Channel Setup Menu

HST1.3.2.1. Receive Data From (T1.4.2.8)

The Receive Data From field determines the side of the line from which data is passed to the analyzer for processing. You may physically select a line side for monitoring by connecting only certain Bantum cables as described in the "Connecting to the Network" section of the *T1 Interface Operation* document. However, if you are receiving both line sides physically and want to restrict the DA-30's analysis of data frames to a specific line side, you may create such a filter with this field.

- BOTH – frames both from the CPE and from the NET are passed to the analyzer.
- FROM CPE – only frames from the CPE (TO CPE IN) are passed to the analyzer.
- FROM NET – only frames from the NET (TO NET IN) are passed to the analyzer.

The default value for this field is BOTH.

HST1.3.2.2. Frame Slicing (T1.4.2.7)

Frame Slicing allows you to shorten the data frame before it is passed to the analyzer for processing. You might want to adjust the frame in this way, if you have no use for the "user data" (the user-generated data contained within the frame), and are only interested in those parts of the frame (generally the frame headers) which are added by specific protocols.

Pressing F1 shows the options, which include NONE (the default), 32, 64, 128, 256, 512 and 1024 bytes. The slicing operation starts at the beginning of the frame. If you select, for instance, to slice at 128 bytes, all data beyond 128 bytes is discarded before reaching the analyzer. An advantage of slicing is that it allows you to maximize the amount of protocol information written to the capture buffer or to the hard disk through logging. A disadvantage of slicing is that you may inadvertently slice the frame in the middle of a protocol header, which makes that protocol invalid for decoding. Your choices regarding slicing (whether to use it, and how far into the frame to slice) are guided by the nature of your application.

HST1.3.2.3. CRC Selection (T1.4.2.4.1)

The CRC Selection field selects the polynomial used during the CRC calculation.

- CCITT-16 – Selects the following 16-bit CCITT polynomial: $(x^{16} + x^{12} + x^{5} + 1)$.
- CRC-32 – Selects the following 32-bit Ethernet polynomial: $(x^{32} + x^{26} + x^{23} + x^{22} + x^{16} + x^{12} + x^{11} + x^{10} + x^{8} + x^{7} + x^{5} + x^{4} + x^{2} + x + 1)$.
- NONE – All CRC checking is disabled. No CRC is generated for transmitted frames, and all received frames are assumed to have good CRCs.

The default type is CCITT-16.

HST1.3.2.4. Idle Line Character (T1.4.2.2.2)

This field determines what the DA-30 interprets as the Idle Line Character.

- FLAG – the DA-30 interprets FLAG (Hex 7E) as an Idle Line Character.
- MARK – the DA-30 interprets MARK (Hex FF) as an Idle Line Character.

The default Idle Line Character is FLAG.

HST1.3.2.5. Display Aborts (T1.4.2.2.1)

This field allows you to select whether aborted frames trigger a specific event in the Network Event Program.

- NO – Aborted frames do not trigger an event in the NEP (default selection).
- YES – Aborted frames do trigger an event in the NEP.

HST1.3.2.6. Invert Data

This field enables the interface to meet MIL-188C signalling requirements by inverting the polarity of the transmit and receive data. The choices are:

- NO – The polarity of the data is left unchanged.
- YES – Inverts the polarity of the data.

HST1.3.3. Voice Channel Setup (T1.4.3)

The Voice Channel Setup menu is identical to the one described for the standard T1 Interface. However, your selections on this menu now slightly depend on your Framing selection on the T1 Line Setup menu. The High Speed T1 Interface does not permit you to turn ON either of the receive codecs or the transmit codec when operating in the UNFRAMED framing mode.

The warning message shown in Figure HST1-3 is displayed just before going to Run Mode whenever the Framing field is set to UNFRAMED **and** either of the codecs (Rx Codec and Tx Codec) are set to ON.

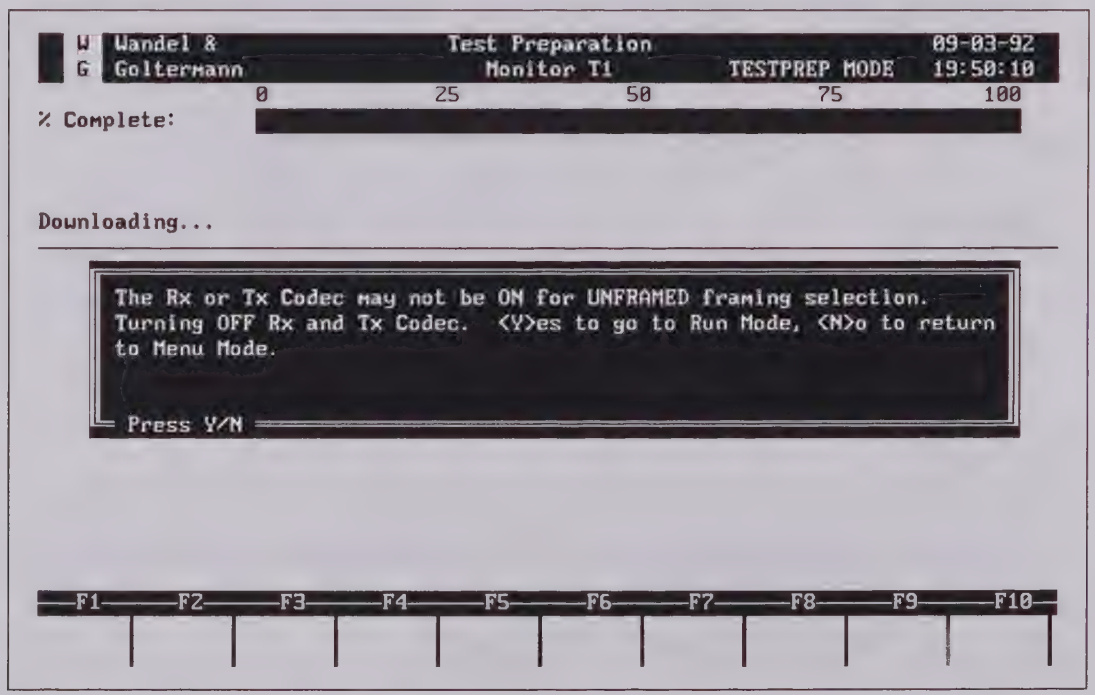

W Wandel &
G Goltermann
Test Preparation
Monitor T1
09-03-92
TESTPREP MODE 19:50:10
0 25 50 75 100
% Complete:
Downloading...
The Rx or Tx Codec may not be ON for UNFRAMED framing selection.
Turning OFF Rx and Tx Codec. <Y>es to go to Run Mode, <N>o to return
to Menu Mode.
Press Y/N
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10

Figure HST1-3 Warning Message When Using the Codecs

HST1.4. The T1 Summary Screen (T1.6.1)

The T1 Summary screen is shown in Figure HST1-4. It differs substantially from the one described for the standard T1 Interface (Figure T1-21).

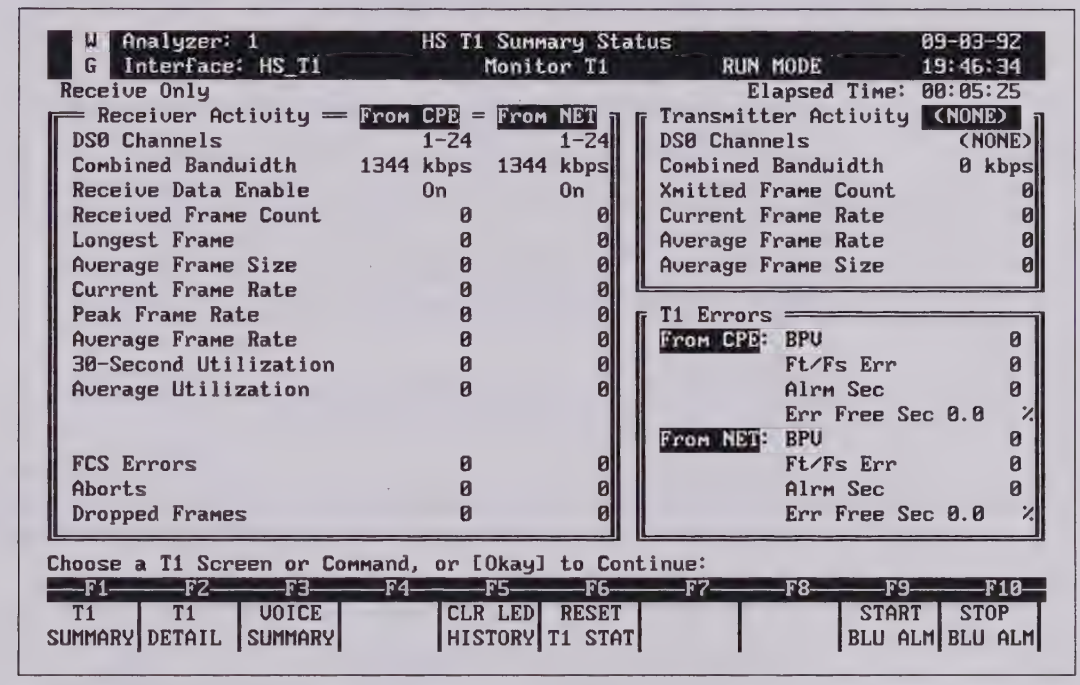

W Analyzer: 1 HS T1 Summary Status 09-03-92
G Interface: HS_T1 Monitor T1 RUN MODE 19:46:34
Receive Only Elapsed Time: 00:05:25
Receiver Activity From CPE From NET
DS0 Channels 1-24 1-24
Combined Bandwidth 1344 kbps 1344 kbps
Receive Data Enable On On
Received Frame Count 0 0
Longest Frame 0 0
Average Frame Size 0 0
Current Frame Rate 0 0
Peak Frame Rate 0 0
Average Frame Rate 0 0
30-Second Utilization 0 0
Average Utilization 0 0
FCS Errors 0 0
Aborts 0 0
Dropped Frames 0 0
Transmitter Activity (NONE)
DS0 Channels (NONE)
Combined Bandwidth 0 kbps
Xmitted Frame Count 0
Current Frame Rate 0
Average Frame Rate 0
Average Frame Size 0
T1 Errors
From CPE: BPV 0
Ft/Fs Err 0
Alrm Sec 0
Err Free Sec 0.0 %
From NET: BPV 0
Ft/Fs Err 0
Alrm Sec 0
Err Free Sec 0.0 %
Choose a T1 Screen or Command, or [Okay] to Continue:
F1 T1 SUMMARY
F2 T1 DETAIL
F3 VOICE SUMMARY
F4
F5 CLR LED HISTORY
F6 RESET T1 STAT
F7
F8
F9 START BLU ALM
F10 STOP BLU ALM

Figure HST1-4 HS_T1 Summary Screen

HST1.4.1. Receiver Activity (T1.6.1.1)

The Receiver Activity section of the screen provides information on the two receivers. The particular receivers viewed are dependent on the Test Function selected in the T1 Line Setup menu. The Receive sides here, and throughout the Network Status screens, correspond to those shown in that menu. For instance, if RECEIVE ONLY is selected as Test Function, the Receive sides are From CPE (physically the TO CPE IN connection) and From NET (the TO NET IN connection). If the Test Function is TX ORIG NET, the Receive Sides are From CPE (the physical connection being TO CPE IN) and To CPE (the signals generated to the TO CPE OUT connector by the DA-30's transmitter). Refer to the "Test Function" section (T1.4.1.4) of the *T1 Interface Operation* document, if these associations and connections are not clear to you. If the Test Function is set to either of the Drop & Insert options (TX D&I NET or TX D&I CPE), the signals from both T1 sides are received and evaluated, prior to the DA-30 action of dropping one or more channels from a side. In these cases, measurements and statistics about the T1 signal come from the receiver (pre-dropped), but the statistics pertaining to data reflect conditions created by the DA-30 transmitter.

For each receiver, the Receiver Activity section displays:

- DS0 Channels – the channels being monitored. "Unframed" is displayed when UNFRAMED framing is used.
- Combined Bandwidth – the combined bandwidth (kbps) of the channels specified in the DS0 Channels field.

  When UNFRAMED framing is used, this field reports 1544 kbps as the combined bandwidth—irrespective of the channels selected for the Voice Channel and Data Channels fields (T1 Line Setup menu).

- Receive Data Enable – This field tells which side of the line (CPE or NET) is enabled for receiving. This field gets its information from the Receive Data From setting on the Data Channel Setup menu (Table 2).

Receive Data From Setting	**Receive Data Enable** Status	
	NET	**CPE**
BOTH	On	On
NET	On	Off
CPE	Off	On

Table 2 Receive Data Enable Status Indicators

Information shown in the following counters is specific to the DS0 channels being monitored (i.e. not to all data in the total T1 pipe):

- Received Frame Count – the total number of frames received. This total includes the number of frames that were processed and the number of frames that were dropped (Dropped Frames). All frame rates and utilization calculations are based on this total.
- Longest Frame – the size (in bytes) of the longest frame that has been received since receiving began. The maximum frame size that can be received is 3928 bytes.
- Average Frame Size – the average size (in bytes) of the received frames since receiving began. The maximum frame size that can be received is 3928 bytes.
- Current Frame Rate – the number of received frames during the last second.
- Peak Frame Rate – the highest frame rate (Frames per second) detected at the receiver since receiving began.
- Average Frame Rate – the current average frame rate (Frames per second).
- 30-Second Utilization – the average utilization (%) for the past 30-second interval. This field is a "sliding-window" that is updated every second. During the first 30 seconds after entering Run Mode, this value is the average utilization for that period.
- Average Utilization – the average utilization (%) since receiving began.
- FCS Errors – this counter is incremented each time a Frame Check Sequence (CRC) error occurs.
- Aborts – this counter is incremented each time an Abort occurs. An Abort is defined to be the reception of seven (7) consecutive one (1) bits.
- Dropped Frames – This field provides a count of the number of frames that the Line Interface was able to receive, but the DA-30 itself could not accept for processing. The frames are "dropped," or thrown away, after being received.

HST1.4.2. Transmitter Activity (T1.6.1.2)

The Transmitter Activity section of the HS_T1 Summary Status screen provides information about the DA-30's transmitter, if enabled. The transmitter follows the Test Function, as specified in the T1 Line Setup menu. For instance, if the Test Function is RECEIVE ONLY, Transmitter Activity is NONE. If the Test Function is TX ORIG CPE, the Transmitter Activity is TO NET (the physical connection being the TO NET OUT line).

For the transmitter, if enabled, the Transmitter Activity section displays:

- DS0 Channels – the channels being used for transmission.
- Combined Bandwidth – the combined bandwidth (kbps) of the channels specified in the DS0 Channels field.

  When UNFRAMED framing is used, this field reports 1544 kbps as the combined bandwidth—irrespective of the channels selected for the Voice Channel and Data Channels fields (T1 Line Setup menu).
- Xmitted Frame Count – the current number of frames that have been transmitted.
- Current Frame Rate – the frame rate for the last second of operation. This field is updated every second.
- Average Frame Rate – the current average rate (Frames per second) at which frames are being transmitted.
- Average Frame Size – the current average size (in bytes) of the transmitted frames since transmission began. The maximum frame size that can be transmitted is 4096 bytes.

HST1.4.3. T1 Errors (T1.6.1.4)

The T1 Errors section of the screen shows error and alarm statistics for the total T1 pipe as seen at the two receivers. As with the Receiver Activity display, the receivers shown are determined by the Test Function selected in the T1 Line Setup menu.

For each receiver, the following measurements are shown:

- BPV – the number of Bipolar Violations. If the B8ZS Line Code is in use, only the actual Bipolar Violations are counted, not those deliberately inserted by the terminal equipment.
- Ft/Fs Err or Ft Errors – the number of Ft/Fs Errors occurring in the bit stream. An Ft/Fs Error is a single instance of a framing bit failing to follow the expected framing pattern, as opposed to the receiver being completely out of frame. This field appears only when using SF (D4) framing.
- CRC6 Errs – the number of CRC6 errors occurring in the T1 signalling. This field appears only when using ESF or ESFz framing.
- LOS Secs – the number of seconds that the received signal has been low—meaning that the T1 line signal has been lost. This field appears only when using UNFRAMED framing.
- Alrm Sec – Alarm Seconds displays the number of seconds during which a Yellow or Blue Alarm has occurred.
- Err Free Sec (% of Elapsed Time) – Error Free Seconds are those seconds during which no Bipolar Violations, CRC6 Errors (ESF) or Ft/Fs (SF) occurred.

HST1.5. The T1 Detail Screen (T1.6.2)

The T1 Detail screen for the High Speed T1 Interface is identical to the one for the standard T1 Interface (Figure 7.T1.22) except all references to "T1" have been replaced with "HS_T1." Figure HST1-5 shows the T1 Detail screen for the High Speed T1 Interface.

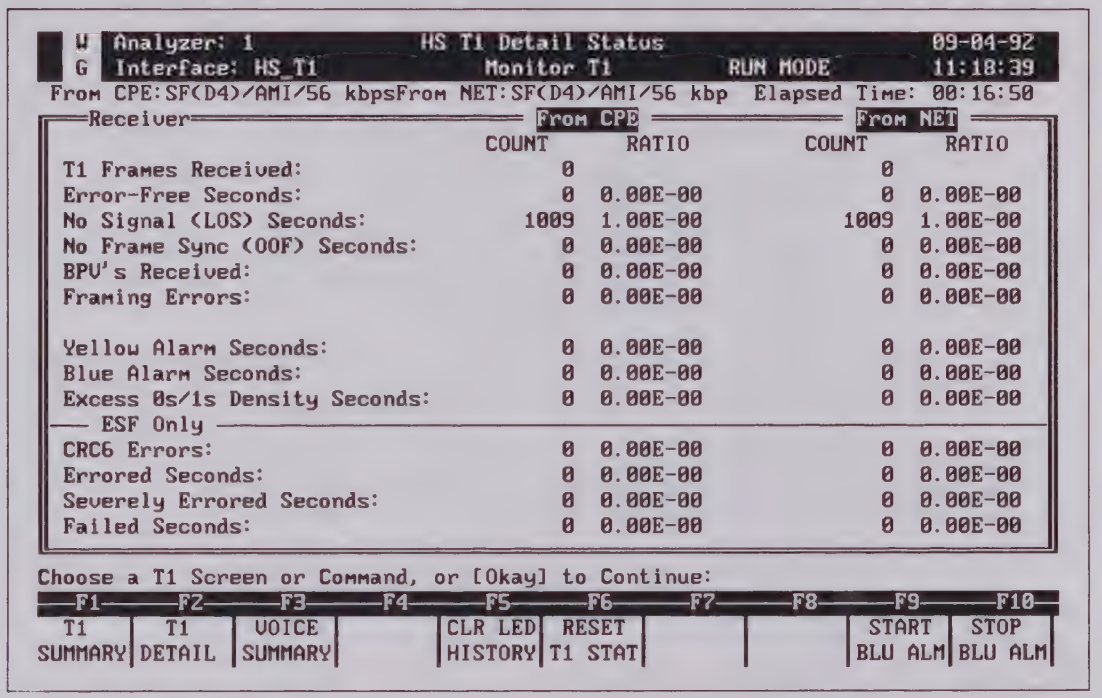

U Analyzer: 1 HS T1 Detail Status 09-04-92
G Interface: HS_T1 Monitor T1 RUN MODE 11:18:39
From CPE:SF(D4)/AMI/56 kbpsFrom NET:SF(D4)/AMI/56 kbp Elapsed Time: 00:16:50
Receiver
From CPE
From NET
COUNT RATIO COUNT RATIO
T1 Frames Received: 0 0
Error-Free Seconds: 0 0.00E-00 0 0.00E-00
No Signal (LOS) Seconds: 1009 1.00E-00 1009 1.00E-00
No Frame Sync (OOF) Seconds: 0 0.00E-00 0 0.00E-00
BPV's Received: 0 0.00E-00 0 0.00E-00
Framing Errors: 0 0.00E-00 0 0.00E-00
Yellow Alarm Seconds: 0 0.00E-00 0 0.00E-00
Blue Alarm Seconds: 0 0.00E-00 0 0.00E-00
Excess 0s/1s Density Seconds: 0 0.00E-00 0 0.00E-00
ESF Only
CRC6 Errors: 0 0.00E-00 0 0.00E-00
Errored Seconds: 0 0.00E-00 0 0.00E-00
Severely Errored Seconds: 0 0.00E-00 0 0.00E-00
Failed Seconds: 0 0.00E-00 0 0.00E-00
Choose a T1 Screen or Command, or [Okay] to Continue:
F1 T1 SUMMARY
F2 T1 DETAIL
F3 VOICE SUMMARY
F4
F5 CLR LED HISTORY
F6 RESET T1 STAT
F7
F8
F9 START BLU ALM
F10 STOP BLU ALM

Figure HST1-5 T1 Detail Screen

HST1.6. The Voice Summary Screen (T1.6.3)

The Voice Summary screen is shown in Figure HST1-6. It differs only slightly from the one described for the standard T1 Interface (Figure 7.T1.23). The screen header shows which Test Function is currently in effect. The display contains an abbreviated form of the T1 Summary screen sections detailing the Receiver Activity, Transmitter Activity and Errors, as well as the Voice Summary. A special softkey rack, allowing manipulation of the voice channels, is accessible from this screen. You can reach this softkey rack by pressing F7 (voice select) while the Voice Summary screen is currently displayed.

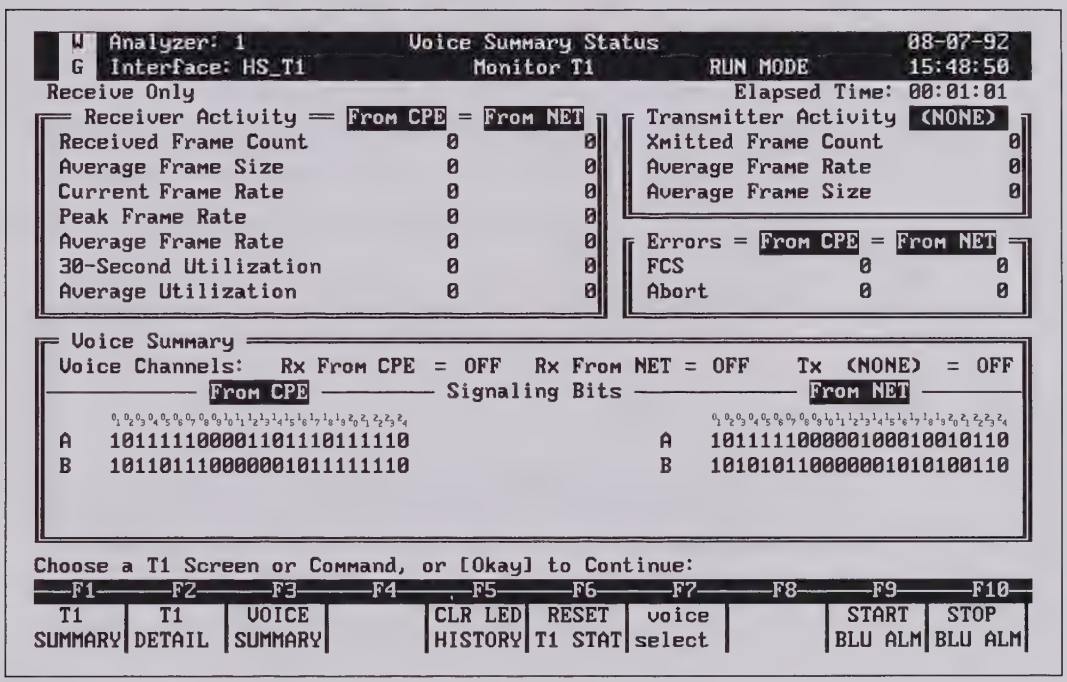

W Analyzer: 1 Voice Summary Status 08-07-92
G Interface: HS_T1 Monitor T1 RUN MODE 15:48:50
Receive Only Elapsed Time: 00:01:01
Receiver Activity = From CPE = From NET
Received Frame Count 0 0
Average Frame Size 0 0
Current Frame Rate 0 0
Peak Frame Rate 0 0
Average Frame Rate 0 0
30-Second Utilization 0 0
Average Utilization 0 0
Transmitter Activity (NONE)
Xmitted Frame Count 0
Average Frame Rate 0
Average Frame Size 0
Errors = From CPE = From NET
FCS 0 0
Abort 0 0
Voice Summary
Voice Channels: Rx From CPE = OFF Rx From NET = OFF Tx (NONE) = OFF
From CPE Signaling Bits From NET
A 1011111000001101110111110 A 1011111000001000100010110
B 1011011100000010111111110 B 1010101100000010101001l0
Choose a T1 Screen or Command, or [Okay] to Continue:
F1 T1 SUMMARY
F2 T1 DETAIL
F3 VOICE SUMMARY
F4
F5 CLR LED HISTORY
F6 RESET T1 STAT
F7 voice select
F8
F9 START BLU ALM
F10 STOP BLU ALM

Figure HST1-6 Voice Summary Screen

HST1.6.1. Receiver Activity (T1.6.3.1)

This section, just like the Receiver Activity section of the T1 Summary screen, displays information about the two receivers. The particular receivers viewed are dependent on the Test Function selected in the T1 Line Setup menu. If the Test Function selected is either of the Drop & Insert options, the signals from both T1 sides are received and evaluated, prior to the DA-30 action of dropping one or more channels from a side. In this case, measurements and statistics used in the Network Status screens reflect the activity on the Receive sides, not the conditions created by the DA-30 transmitter.

For each receiver, the Receiver Activity section displays:

- Received Frame Count – the total number of frames received. This total includes the number of frames that were processed and the number of frames that were dropped (Dropped Frames). All frame rates and utilization calculations are based on this total.
- Average Frame Size – the average size (in bytes) of the received frames since receiving began. The maximum frame size that can be received is 3928 bytes.
- Current Frame Rate – the number of received frames during the last second.
- Peak Frame Rate – the highest frame rate (Frames per second) detected at the receiver since receiving began.

- Average Frame Rate – the current average frame rate (Frames per second).
- 30-Second Utilization – the average utilization (%) for the past 30-second interval. This field is a "sliding-window" that is updated every second. During the first 30 seconds after entering Run Mode, this value is the average utilization for that period.
- Average Utilization – the average utilization (%) since receiving began.

HST1.6.2. Transmitter Activity (T1.6.3.2)

The Transmitter Activity section of the Voice Summary screen is essentially the same as that described for the T1 Summary screen. Again, the particular transmitter monitored follows the Test Function, as specified in the T1 Line Setup menu.

For the transmitter, if enabled, the Transmitter Activity screen section displays:

- Xmitted Frame Count – the current number of frames that have been transmitted.
- Average Frame Rate – the current average rate (Frames per second) at which frames are being transmitted.
- Average Frame Size – the current average size (in bytes) of the transmitted frames since transmission began. The maximum frame size that can be transmitted is 4096 bytes.

HST1.6.3. Errors (T1.6.3.3)

Just as in the T1 Summary screen, the Errors section of the display maintains running counters of data errors in the DS0 channels analyzed by the two receivers monitored as a result of the choice of Test Function. Errors monitored include:

- FCS – this counter increments when a Frame Check Sequence error occurs
- Abort – this counter increments when an Abort condition occurs.

HST1.6.4. Voice Summary (T1.6.3.4)

The Voice Summary section of the screen shows the condition of the voice channels in use, both transmit and receive, and the status of the signaling bits for the two receivers.

HST1.6.4.1. Voice Channels (T1.6.3.4.1)

As with data on the T1 circuit, the DA-30 can receive on two voice channels and transmit on one. The Voice Channels indicators show OFF if the use of a channel for voice is not enabled. If the channel is enabled for voice, the channel # is shown.

Note:

Because all the codecs are turned off whenever UNFRAMED framing is used, their corresponding Voice Channel indicators will display OFF—regardless of the settings on the Voice Channel Setup menu.

HST1.6.4.2. Signaling Bits (T1.6.3.4.2)

This sub-section of the Voice Summary screen is basically unchanged. However, no signaling information is displayed when operating in the UNFRAMED framing mode since there is no channel available for voice in this mode.

HST1.6.4.3. T1 Softkey-Generated Commands – Voice Select (T1.6.5)

This softkey rack operates as described for the standard T1 Interface. However, the High Speed T1 Interface does not permit the use of these voice commands when operating in the UNFRAMED framing mode. The following warning message is displayed when the Framing field is set to UNFRAMED and either of the voice command softkeys are pressed:

```
WARNING: Voice commands are not allowed for UNFRAMED framing selection.
```

2 Mbps - ETSI Line Interface Operation Errata Sheet September 1995

Please note the following warning regarding connecting the 2 Mbps - ETSI line interface to high voltages.

WARNING:

The 2 Mbps - ETSI line interface is not intended for measurements at, and must never be connected to, repeaters or other access points containing hazardous voltages.

First Edition March 1994 Release 3.4.2 and after

2 Mbps ETSI

2 Mbps - ETSI Interface Operation

ETSI.1. Introduction

This document describes the interface and protocol-specific operation of the DA-3x with Version 1.0 of the 2 Mbps - ETSI Line Interface Package (LIP). It describes the various setup menus and statistics screens, hardware installation, and the external connections necessary to perform tests on a 2 Mbps network.

The 2 Mbps - ETSI Interface provides the DA-3x access to 2 Mbps data services. These services can use private or public networks and include primary rate ISDN (Integrated Services Digital Network). Equipped with two receivers and one transmitter, this interface enables the DA-3x to monitor and/or generate traffic on an ETSI and CCITT G.703 compliant 2 Mbps network link. It also supports CEPT/G.703 non-ISDN networks. All standard 2 Mbps functions are supported including:

- HDB-3 line coding
- CCITT G.704 data framing
- Unframed data

Moreover, by using an external handset, you can monitor one voice channel from each receiver as well as insert voice data from the handset into a voice channel in the outgoing 2 Mbps bit stream.

ETSI.1.1. 2 Mbps Communications Systems

Two widely known pulse-code modulation (PCM) communications systems are in operation today. The first system (known as T1) is based on 24 channels of voice/data that are time-division multiplexed into a 1.544 Mbit/s bit stream. T1 is used mainly in the United States, Canada and Japan. The second system (sometimes referred to as E1) is based on 30 channels of voice/data that are time-division multiplexed into a 2.048 Mbit/s bit stream. This system is used primarily in European and certain non-European countries. Throughout the rest of this document, the term "2 Mbps" is used rather than 2.048 Mbit/s.

The 2 Mbps frame consists of 32 time slots (Figure ETSI-1). A time slot is used to carry 8 bits of data or encoded voice sampled at 8 kHz. This results in a time slot capacity of 64 kbit/s. Time slot 0 is used to carry frame alignment signals, and time slot 16 is used to carry other signaling information. The 32 time slots have a total capacity of 256 bits per frame resulting in

a bit rate of 2.048 Mbits/s (8 kHz x 256 bits). A group of sixteen 2 Mbps frames make a multiframe.

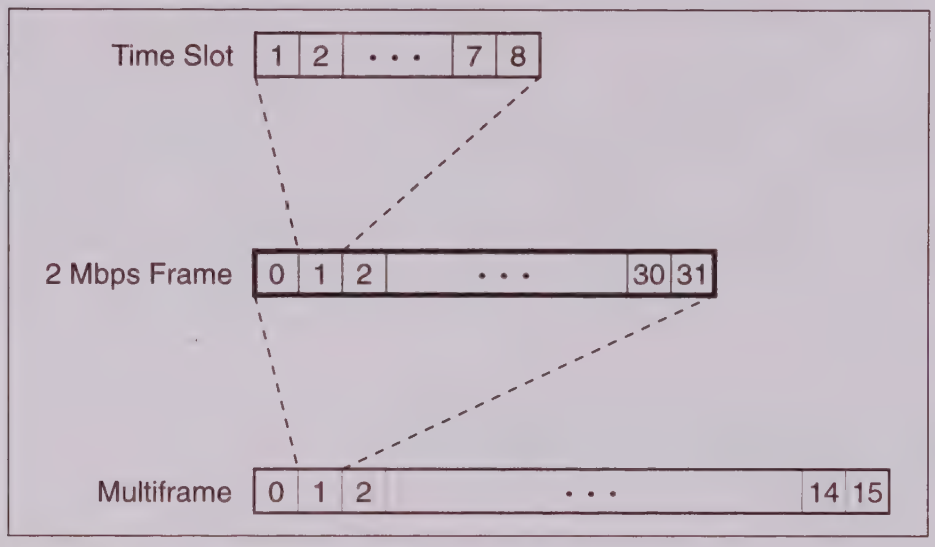


Figure ETSI-1 2 Mbps Frame Format

Figure ETSI-2 shows a simple 2 Mbps transmission link.

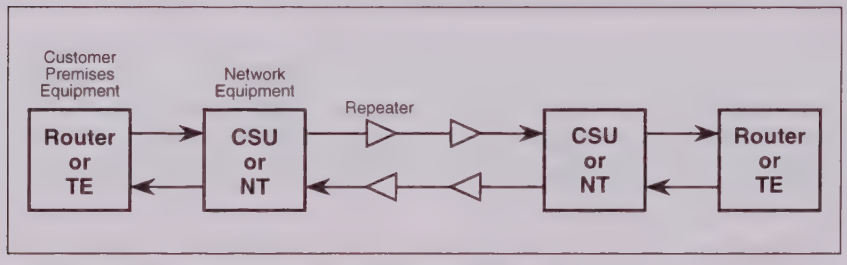


Figure ETSI-2 Simple 2 Mbps Transmission Link

It consists of two pairs of wires (one for each direction), a series of repeaters, network equipment at one end of the link and customer premises equipment at the other end. Network equipment and customer premises equipment are hereafter referred to as Network and CPE, respectively.

The 2 Mbps - ETSI Interface regards the 2 Mbps bit stream as a digital pipe (Figure ETSI-3). This digital pipe is sub-divided into two parts: data channels and voice channels. In addition to reporting statistics on the total 2 Mbps pipe, the 2 Mbps - ETSI Interface can provide separate statistics on the data and voice channels.

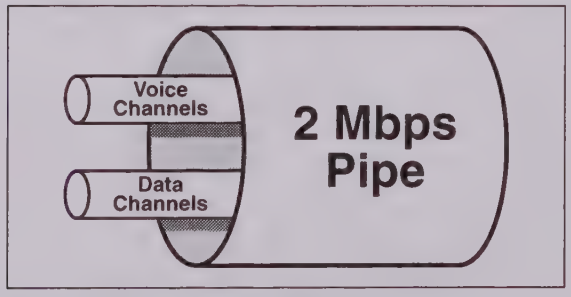


Figure ETSI-3 2 Mbps Digital Pipe

You are assumed to have a basic understanding of 2 Mbps systems. For more information on 2 Mbps systems, refer to:

CCITT 2048 KB/S Frame Structure and Measurement Techniques, Technical Information, W&G Document.

The world of E1 – An introduction to 2.048 Mbit/s Systems, W&G Internal Technical Document.

CCITT G.703, Physical/electrical characteristics of hierarchical digital interfaces.

CCITT G.704, Synchronous frame structures used as Physical/electrical characteristics of hierarchical digital interfaces.

ETSI.2. Installation

The 2 Mbps Interface consists of the following:

- Line Interface Module
- Line Interface Package (LIP)
- Layer Protocol Package (LPP)

In order to perform 2 Mbps testing, the line interface module must be paired with a High Speed WAN Feature Module. They should occupy either DA-3x slots 4 and 5 or 6 and 7.

> **Note:**
>
> Before you can use the 2 Mbps Interface to test a 2 Mbps circuit, you must also have a Protocol Analyzer Module installed.

ETSI.2.1. Installing the Line Interface Module and Installing LIP & LPP Software on the Hard Disk

Installing the Line Interface Module:

For instructions on how to install the 2 Mbps Line Interface Module, refer to the installation procedures described in the "Installing Hardware Accessories" appendix of the DA-30/31 Operating Manual.

Installing the LIP & LPP Software:

For instructions on how to install the LIP & LPP software onto the hard disk, refer to the installation procedures described in the "Installing Software" appendix of the DA-30/31 Operating Manual.

ETSI.2.2. Loading & Running 2 Mbps Applications

After booting up your DA-30, you can run any existing 2 Mbps applications (e.g. MONHS_2M) directly from the Application Management screen. For instructions on how to load and run applications, refer to the procedures described in the "Applications" chapter of the *DA-30/31 Operating Manual.*

ETSI.2.3. The Rear Panel

The rear panel of the 2 Mbps Interface Module (Figure ETSI-4) consists of four ports.

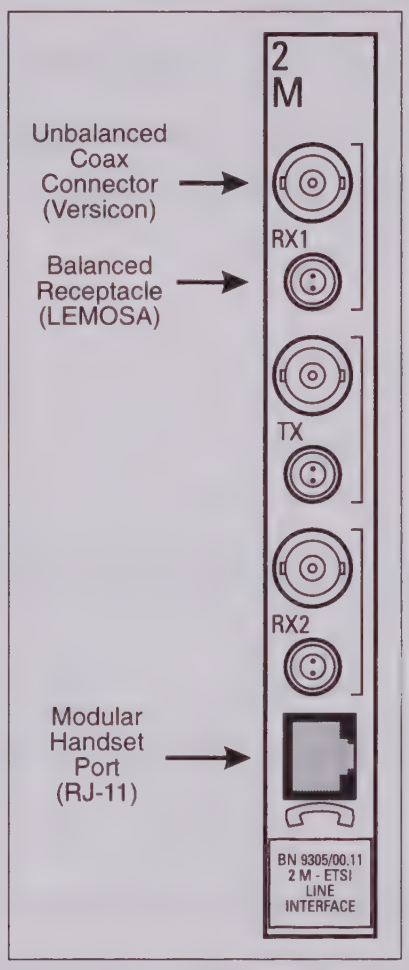


Figure ETSI-4 2 Mbps-ETSI Rear Panel

From top to bottom, the first three ports are labeled as follows:

- RX1 (Receive 1)
- TX (Transmit)
- RX2 (Receive 2)

The fourth port is labeled with a telephone handset symbol.

RX1 Port:

The RX1 port consists of two connectors that allow you to physically connect the 2 Mbps - ETSI Interface to a variety of 2 Mbps devices. This port allows the 2 Mbps - ETSI Interface to monitor 2 Mbps traffic on one or more time slots.

At the top is a W&G Versacon® connector that is adapted for BNC-type, 75 Ohm, unbalanced connections. At the bottom is a LEMO connector that is for 120 Ohm, balanced connections. With the use of optional 2 Mbps adapter cables (Figure ETSI-5), you can connect the 2 Mbps - ETSI Interface to devices requiring other types of connectors. Both balanced and unbalanced adapter cables are available.

Balanced adapter cables come with a LEMO connector at one end. At the other end, either a TF, Bantam, or Open Ended connection is provided. The Open Ended connection allows you to attach other connectors to the cable. Unbalanced adapter cables come with a BNC connector at both ends.

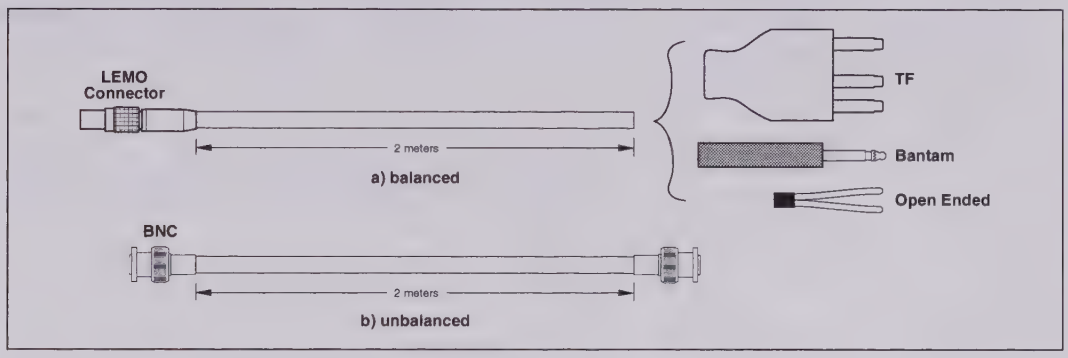


Figure ETSI-5 Optional 2 Mbps Adapter Cables

TX Port:

The TX port consists of two connectors that allow you to physically connect the 2 Mbps - ETSI Interface to a variety of 2 Mbps devices. This port allows the 2 Mbps - ETSI Interface to transmit 2 Mbps traffic on one or more time slots.

At the top is a W&G Versacon® connector that is adapted for BNC-type, 75 Ohm, unbalanced connections. At the bottom is a LEMO connector that is for 120 Ohm, balanced connections. With the use of optional 2 Mbps adapter cables (Figure ETSI-5), you can connect the 2 Mbps - ETSI Interface to devices requiring other types of connectors. Both balanced and unbalanced adapter cables are available.

Balanced adapter cables come with a LEMO connector at one end. At the other end, either a TF, Bantam, or Open Ended connection is provided. The Open Ended connection allows you to attach other connectors to the cable. Unbalanced adapter cables come with a BNC connector at both ends.

RX2 Port:

The RX2 port consists of two connectors that allow you to physically connect the 2 Mbps - ETSI Interface to a variety of 2 Mbps devices. This port allows the 2 Mbps - ETSI Interface to monitor 2 Mbps traffic on one or more time slots.

At the top is a W&G Versacon® connector that is adapted for BNC-type, 75 Ohm, unbalanced connections. At the bottom is a LEMO connector that is for 120 Ohm, balanced connections. With the use of optional 2 Mbps adapter cables (Figure ETSI-5), you can connect the 2 Mbps - ETSI Interface to devices requiring other types of connectors. Both balanced and unbalanced adapter cables are available.

Balanced adapter cables come with a LEMO connector at one end. At the other end, either a TF, Bantam, or Open Ended connection is provided. The Open Ended connection allows you to attach other connectors to the cable. Unbalanced adapter cables come with a BNC connector at both ends.

Modular Handset Port:

The modular handset port is a RJ-11 jack that can be used to transmit and receive A-law encoded voice via an optional telephone handset. You can monitor one voice channel from each receiver. In addition, you can insert a voice channel into the outgoing 2 Mbps stream.

Card Ejector:

A card ejector button, used to disconnect the 2 Mbps - ETSI Line Interface Module from the DA-3x backplane, is located at the bottom of the rear panel.

ETSI.2.4. Making the Connections

The 2 Mbps - ETSI Interface allows you to monitor and generate traffic on a 2 Mbps network. The 2 Mbps - ETSI Interface can be set up in one of three possible operating modes:

- Monitor
- Emulate
- Drop and Insert

For information on how to set up the 2 Mbps - ETSI Interface in one of these three modes, refer to Section 3.1.1.3, "Test Function."

The following sections illustrate the major connection schemes for the three modes.

> **Note:**
>
> The network configuration drawings are conceptual and are not meant to be regarded as detailed connection diagrams.

ETSI.2.4.1. Monitoring

The 2 Mbps - ETSI Interface can be configured to passively monitor all or a portion of the 2 Mbps data stream. It can gather statistics on any combination of time slots within a received 2 Mbps frame. If monitoring both sides of the line, the 2 Mbps - ETSI Interface can simultaneously monitor different combinations of time slots on RX1 and RX2.

Figure ETSI-6 shows how the internal signal paths are configured for monitoring.

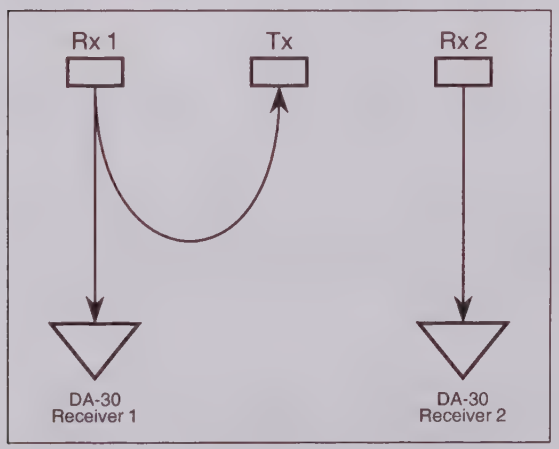


Figure ETSI-6 Internal Signal Path: Monitoring

Data received on RX1 is simultaneously routed to Receiver 1 circuitry for statistical analysis and looped back out on TX. This loopback path presents a high impedance so that the DA-3x does not interfere with normal traffic. Data received on RX2 is routed to Receiver 2 circuitry for statistical analysis.

There are two basic monitoring configurations: Off Line and Through.

In the Off Line monitoring configuration, connect the receiver ports (RX1 and RX2) to the protected monitor jacks (if provided) of the Network as shown in Figure ETSI-7a. Configure both receivers to terminate the line (see Section 3.1.2.1, "Rx Termination"). Using these jacks is the preferred method of unobtrusive monitoring because their high impedance provides the best protection for your 2 Mbps network. However, if protected monitor jacks are not provided, you can vary this configuration by using wire taps as shown in Figure ETSI-7b. Tap both of the transmission links and connect each one to a receiver port. Configure both receivers to bridge line terminations (see Section 3.1.2.1, "Rx Termination").

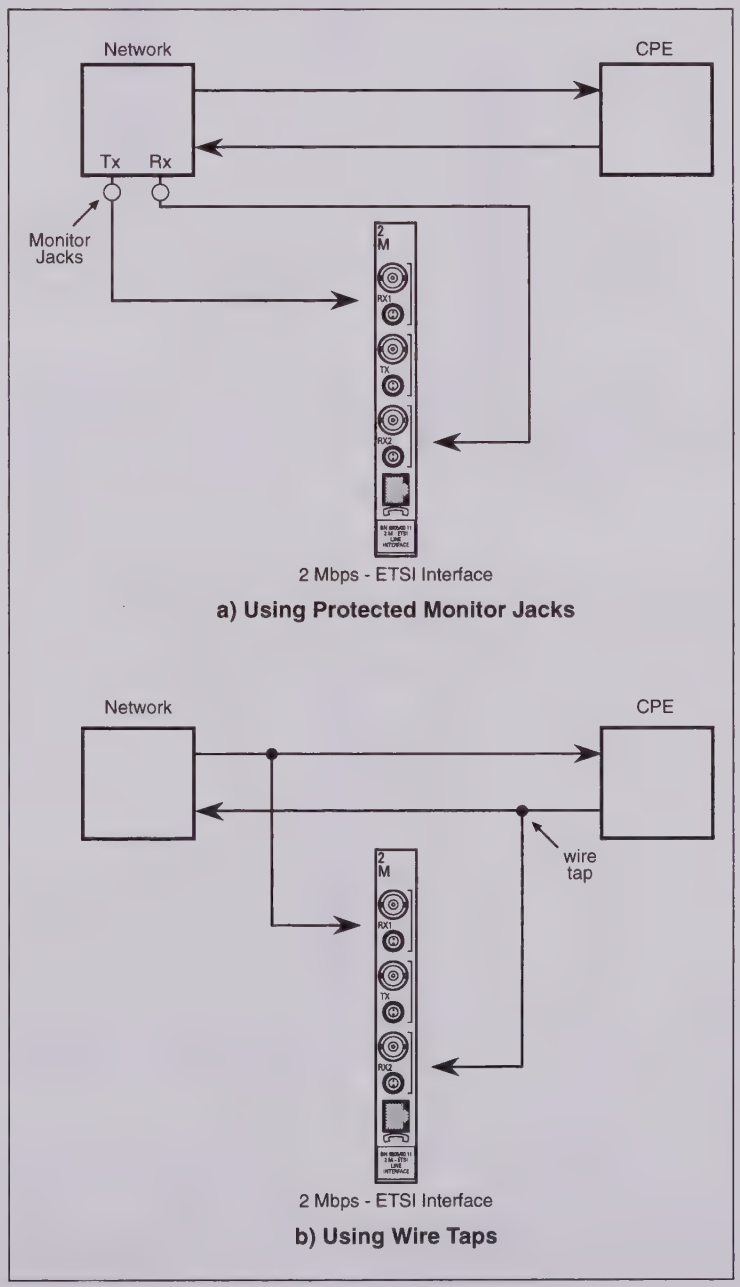


Figure ETSI-7 Off Line Monitoring Configuration:
(a) Using monitor jacks
(b) Using wire taps

In Monitoring Configuration 2 (Figure ETSI-8), connect the transmit port of the Network to the RX1 port of the 2 Mbps - ETSI Line Interface Module. Connect the TX port to the receive port of the CPE. Then simply tap the other transmission link, from the CPE to the Network, and connect it to the RX2 port.

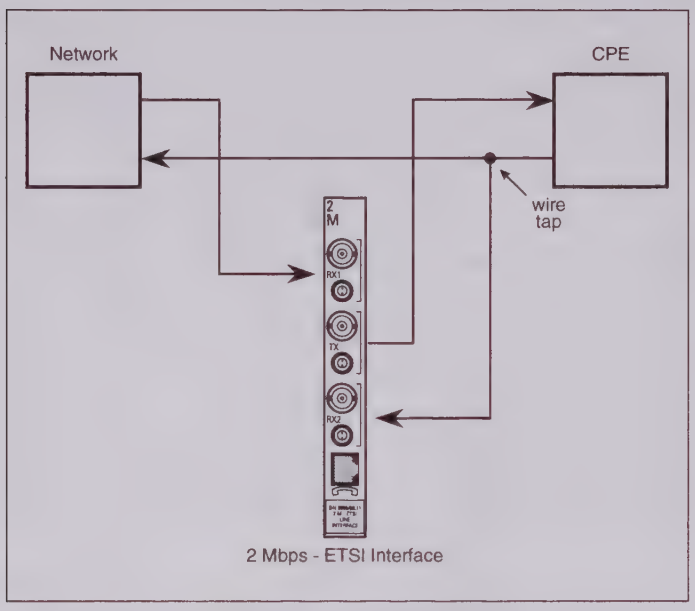


Figure ETSI-8 Through Monitoring Configuration

ETSI.2.4.2. Emulation

The 2 Mbp - ETSI Interface actively transmits voice/data on one or more time slots. The 2 Mbps - ETSI Interface can emulate a Network as well as a CPE.

Figure ETSI-9 shows how the internal signal paths are configured for emulation.

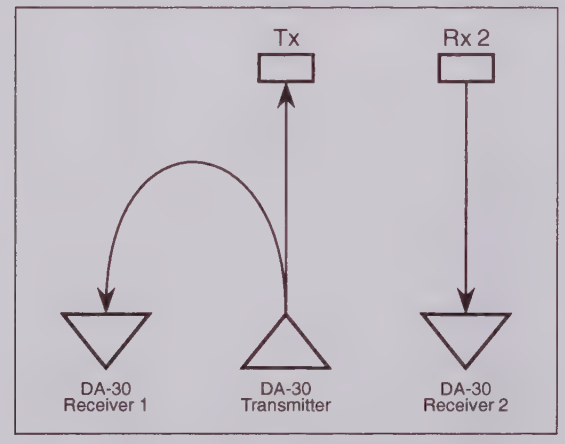


Figure ETSI-9 Internal Signal Paths: Emulation

Data that is received on RX2 is routed to Receiver 2 circuitry for statistical analysis. Data that is generated by the Transmitter is simultaneously routed to the TX and looped back to Receiver 1 circuitry for statistical analysis.

To configure the interface to emulate a Network (Figure ETSI-10), connect the TX port of the 2 Mbps - ETSI Interface to the receive port of the CPE. Then connect the transmit port of the CPE to the RX2 port.

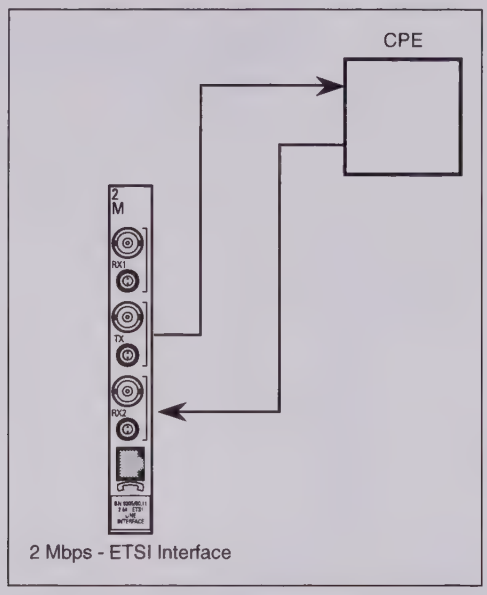


Figure ETSI-10 Emulate Network Configuration

To configure the interface to emulate a CPE (Figure ETSI-11), connect the TX port of the 2 Mbps - ETSI Interface to the receive port of the Network. Then connect the transmit port of the Network to the RX2 port.

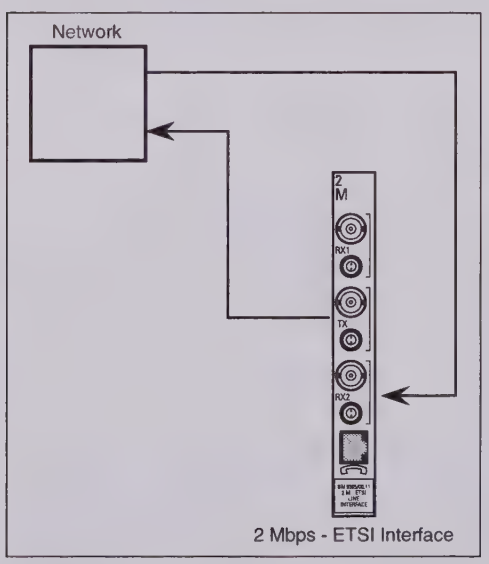


Figure ETSI-11 Emulate CPE Configuration

ETSI.2.4.3. Drop and Insert

When operating in the drop and insert mode, the 2 Mbps - ETSI Interface can remove voice/data from one or more incoming time slots and replace it with voice/data generated by the Transmitter before retransmitting it.

Figure ETSI-12 shows how the internal signal paths are configured for drop and insert.

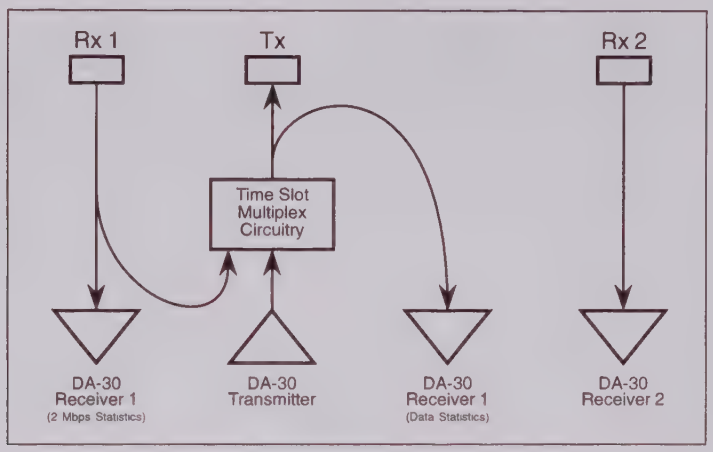


Figure ETSI-12 Internal Signal Paths: Drop & Insert

Data that is received on RX2 is routed to Receiver 2 circuitry for statistical analysis. Data that is received on RX1 is simultaneously routed to Receiver 1 for 2 Mbps pipe and voice statistics and to the time slot multiplex circuitry where selected frames are dropped and replaced with data generated by the Transmitter. After the drop and insert process, the resulting frame is simultaneously routed to TX and Receiver 1 for data statistics.

To configure the interface to drop and insert Network time slots (Figure ETSI-13), connect the transmit port of the Network to the RX1 port of the 2 Mbps - ETSI Interface. Then connect the TX port to the receive port of the CPE. You can also monitor traffic on the transmission link from the CPE to the Network by tapping the link and connecting it to the RX2 port.

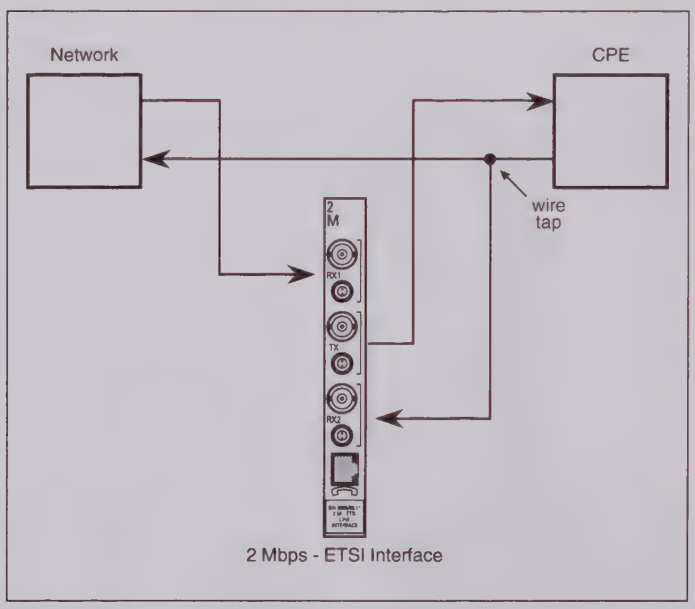


Figure ETSI-13 Dropping & Inserting Network Time Slots

To configure the interface to drop and insert CPE time slots (Figure ETSI-14), connect the transmit port of the CPE to the RX1 port of the 2 Mbps - ETSI Interface. Then connect the TX port to the receive port of the Network. You can also monitor traffic on the transmission link from the Network to the CPE by tapping the link and connecting it to the RX2 port.

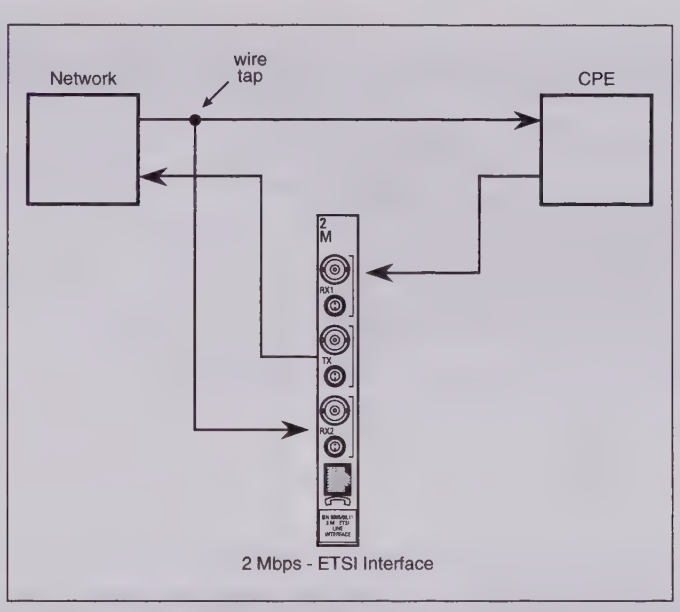


Figure ETSI-14 Dropping & Inserting CPE Time Slots

ETSI.2.4.4. Connecting to the Handset Jack

You can connect an optional telephone handset to the standard RJ-11 port in any of the above test configurations. Any channel of a 2 Mbps frame, regardless of the operating mode, can be monitored. However, any channel can also be used for transmitting a voice signal, but only in Emulate mode.

Note:

This handset connection is not intended for exhaustive voice-grade diagnostics. It is intended only to provide a convenient way to verbally communicate with others working with the same 2 Mbps link.

ETSI.3. Setting Up the 2 Mbps Interface

After you have installed the 2 Mbps - ETSI Line Interface Module in the DA-3x, installed the LIP and LPP software, and made the appropriate connections for monitoring or emulation, you are ready to set up the interface for your particular test. The 2 Mbps - ETSI Interface offers the following three setup menus:

- 2 Mbps Line Setup
- Data Channel Setup
- Voice Channel Setup

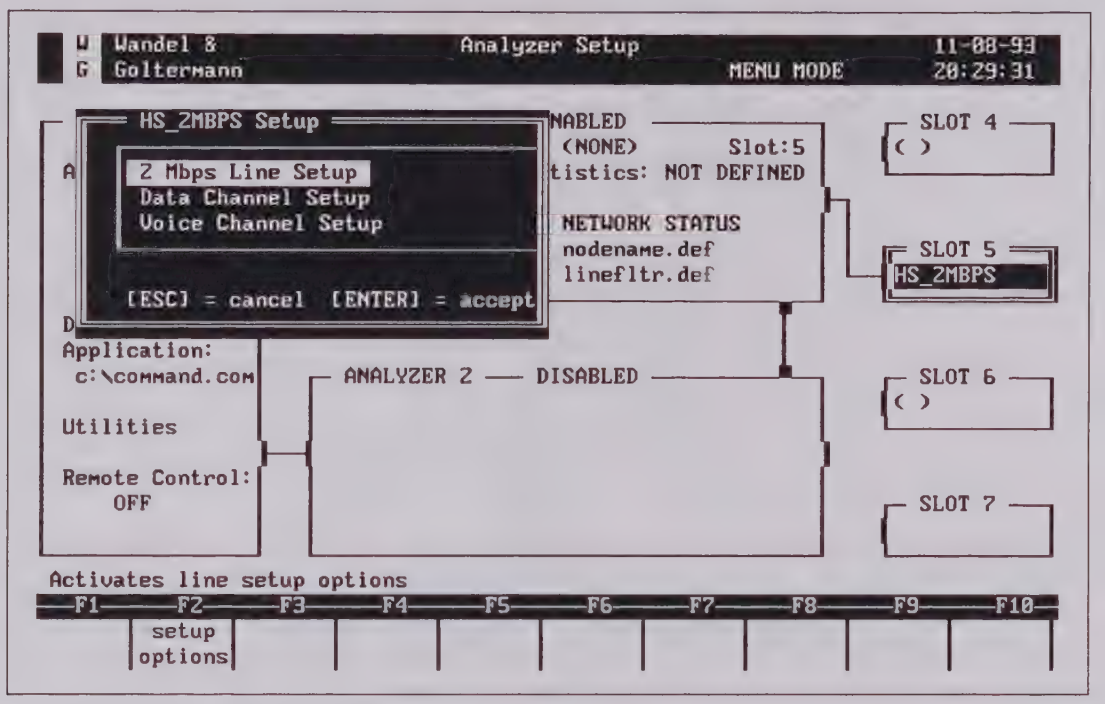


Figure ETSI-15 2 Mbps Top-Level Setup Menu

ETSI.3.1. The 2 Mbps Line Setup

The 2 Mbps Line Setup menu (Figure ETSI-16) consists of three sections: Common, Receive and Transmit.

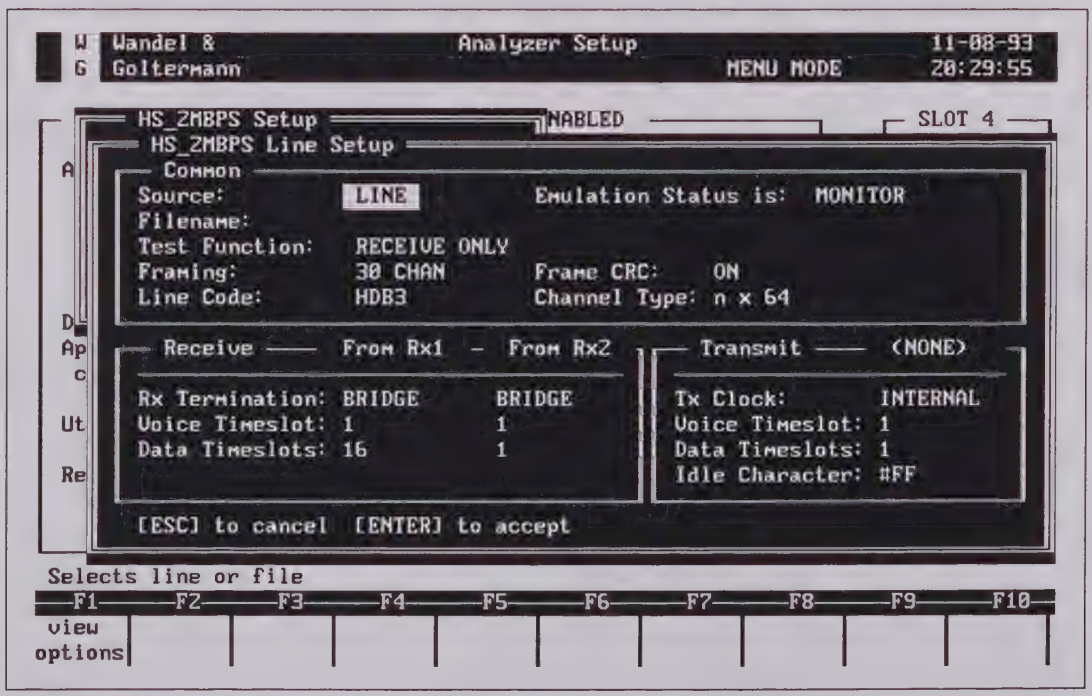


Figure ETSI-16 2 Mbps Line Setup Menu

ETSI.3.1.1. Common

Use the Common section of the 2 Mbps Line Setup menu to set parameters that are common to both transmit and receive operations. Each of the fields are described in the following sections.

ETSI.3.1.1.1. Source

Use this field to select the source of the data that the DA-3x is to analyze. The choices are:

- LINE – The physical 2 Mbps network is the source of the data.
- FILE – A logged data file is the source of the data.

ETSI.3.1.1.2. Filename

When the Source field is set to FILE, you can enter the name of the logged data file in this field. To see a list of available filenames to choose from, press F1 (view options). Use the cursor keys to highlight a filename in the list, and press Enter to load the file.

ETSI.3.1.1.3. Test Function

Use this field to select the operation mode of the 2 Mbps - ETSI Interface. The following three choices are available:

- RECEIVE ONLY – the DA-3x passively monitors traffic from both receivers. Incoming traffic on RX1 is looped back out on TX. This loopback path presents a high impedance so that the DA-3x does not interfere with normal traffic. This selection requires that the receivers be bridged (see Section 3.1.2.1, "Rx Termination").

  In this mode, you can gather statistics on any combination of time slots on both receivers. The transmitter is disabled.

- EMULATE – the DA-3x emulates either a Network or a CPE. In this mode, you can transmit voice/data on one or more time slots. Frames that are generated by the Transmitter are also monitored by Receiver 1.

- DROP&INS – the DA-3x emulates either a Network or a CPE. In this mode, you can specify that the contents of certain time slots of an incoming frame be emptied and replaced with voice/data that is generated by the Transmitter. The Transmit Clock is LOOP TIMED.

Figure ETSI-17 demonstrates the drop and insert process. The interface demultiplexes the incoming frame into its 32 component time slots. You can then specify certain time slots to be "dropped" (i.e. the signals are removed from the time slot), and replaced ("inserted") with signals generated by the Transmitter. In Step 1, the frame is received by the 2 Mbps - ETSI Interface, which demultiplexes it into its 32 component time slots. In Step 2, time slots 1, 2 and 3 are dropped (shown as the signals in the time slots being pushed into the bit bucket) and replaced by signals (data and/or voice) from the Transmitter. In Step 3, the re-multiplexed frame is transmitted back to the line.

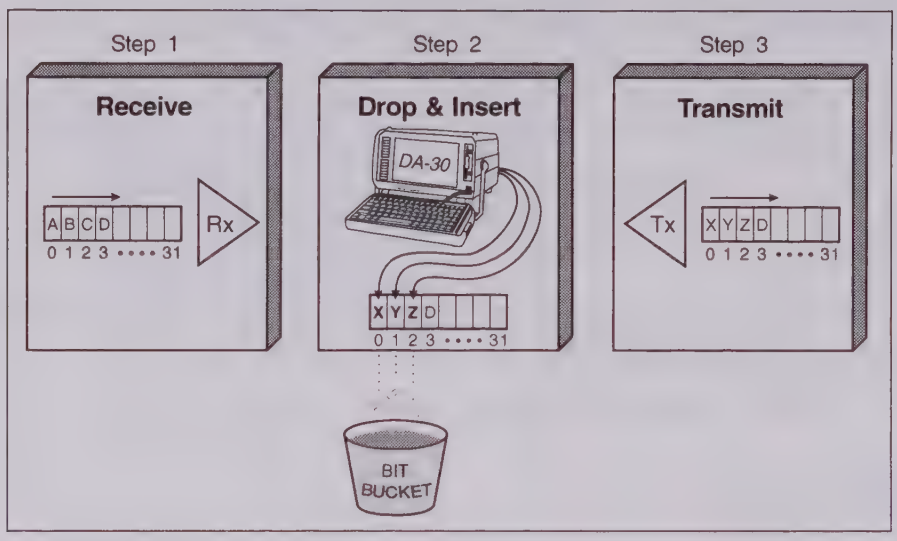


Figure ETSI-17 Drop & Insert Process

Note:

Whenever Frame CRC is set to ON, the 2 Mbps - ETSI Interface does not implement a "true" drop and insert function. This is because the interface regenerates the framing information, contained in time slot 0, instead of simply passing it through. However, when Frame CRC is set to OFF, the interface passes framing information undisturbed.

ETSI.3.1.1.4. Framing

Use this field to select the CCITT framing system that is used for the 2 Mbps bit stream. Three systems are available:

- 30 CHAN – The 30 channel framing system is used (Figure ETSI-18). In this system, 30 of the 32 available time slots are used for voice/data signals. Voice/data are transmitted in time slots 1 to 15 and 17 to 31. Time slots 0 and 16 have special uses.

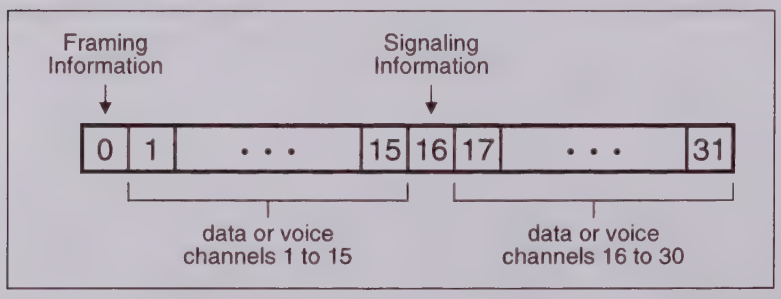


Figure ETSI-18 30 Channel System

Time Slot 0:

Time slot 0 is used to carry a variety of framing information (Figure ETSI-19). The interpretation of the bit positions in time slot 0 is different for even and odd numbered frames of the multiframe. For the purposes of this discussion, bits are numbered 1 to 8 in the order in which they are received.

Time Slot 0

Frame #	1	2	3	4	5	6	7	8
0	S_i / C_1	0	0	1	1	0	1	1
1	S_i / 0	1	A	S_{a4}	S_{a5}	S_{a6}	S_{a7}	S_{a8}
2	S_i / C_2	0	0	1	1	0	1	1
3	S_i / 0	1	A	S_{a4}	S_{a5}	S_{a6}	S_{a7}	S_{a8}
4	S_i / C_3	0	0	1	1	0	1	1
5	S_i / 1	1	A	S_{a4}	S_{a5}	S_{a6}	S_{a7}	S_{a8}
6	S_i / C_4	0	0	1	1	0	1	1
7	S_i / 0	1	A	S_{a4}	S_{a5}	S_{a6}	S_{a7}	S_{a8}
8	S_i / C_1	0	0	1	1	0	1	1
9	S_i / 1	1	A	S_{a4}	S_{a5}	S_{a6}	S_{a7}	S_{a8}
10	S_i / C_2	0	0	1	1	0	1	1
11	S_i / 1	1	A	S_{a4}	S_{a5}	S_{a6}	S_{a7}	S_{a8}
12	S_i / C_3	0	0	1	1	0	1	1
13	S_i / E	1	A	S_{a4}	S_{a5}	S_{a6}	S_{a7}	S_{a8}
14	S_i / C_4	0	0	1	1	0	1	1
15	S_i / E	1	A	S_{a4}	S_{a5}	S_{a6}	S_{a7}	S_{a8}

CRC Multiframe

Figure ETSI-19 Time Slot 0 Organization

In even numbered frames, bit 1 (Si) is reserved for international use and is normally set to 1. If frame CRC (CRC-4) is being used, bit 1 is set to the value of one of the CRC-4 check bits (see Section 3.1.1.7, "Frame CRC"). Bits 2 to 8 contain the fixed pattern (0011011) of the Frame Alignment Signal (FAS).

In odd numbered frames, bit 1 (Si) is reserved for international use and normally set. If frame CRC (CRC-4) is being used, bit 1 is set to the value of one of the CRC Multiframe Alignment Signal bits (001011). Thus, bit 1 is set to 0 in frame 1, 0 in frame 3, 1 in frame 5, etc. In frames 13 and 15, bit 1 contains the CRC error indication bits (E bits). These bits are used to signal to the transmitting side that a CRC error was detected. An E bit is set to 0 to indicate an error. For equipment which does not use E bits, these bits can be set to 1.

Bit 2 of odd numbered frames is known as the Not Frame Alignment Signal (NFAS) and is used to keep bits 2 to 8 from being interpreted as an FAS. It is always set to 1.

Bit 3 (A) of odd numbered frames is the Remote Alarm Indication signal. It is set to 1 to indicate a remote alarm condition.

Bits 4 to 8 (S_{a4} to S_{a8}) of odd numbered frames are spare bits which reserved for individual country use. If not used, they should be set to 1.

Time Slot 16:

Time slot 16 is used to carry framing patterns as well as signaling information. Time slot 16 in frame 0 carries the framing pattern (Figure ETSI-20).

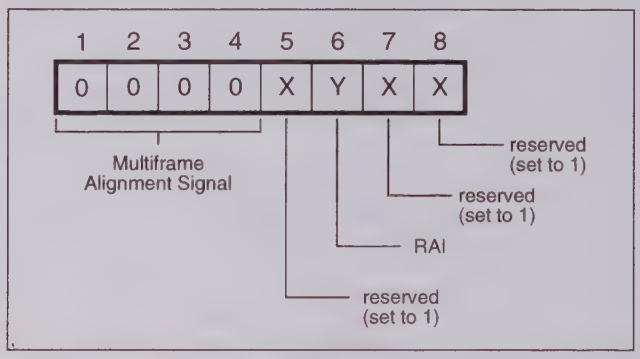


Figure ETSI-20 Time Slot 16 (Frame 0) Framing Information

Bits 1 to 4 carry the Multiframe Alignment Signal (MFAS) and are always set to 0. Bits 5, 7 and 8 are unallocated and set to 1. Bit 6 is the RAI signal and is set to 1 to indicate a remote alarm condition.

Time slot 16 in frames 1 to 15 carries Channel-Associated Signaling (CAS) information. See Section 6.3.4.2, "Signaling Bits."

- 31 CHAN – The 31 channel framing system is used (Figure ETSI-21). This system is identical to the 30 channel system except that time slot 16 is used for voice/data. Signaling information is provided by some other method (e.g. Signaling System 7).

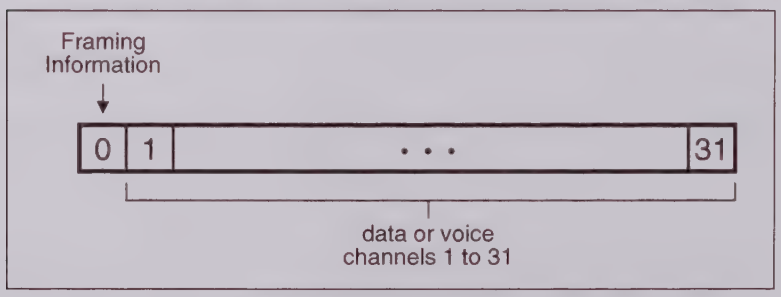


Figure ETSI-21 31 Channel System

- UNFRAMED – No framing is provided. The bit stream is regarded as one 2.048 Mbit/s channel (Figure ETSI-22). Use this selection when proprietary framing systems are used on your 2 Mbps network.

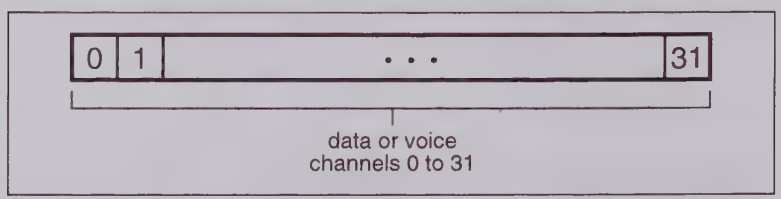


Figure ETSI-22 Unframed System

Additional framing options are available by pressing F2 (alt framing) from the Framing softkey rack. Figure ETSI-23 shows the alt framing menu.

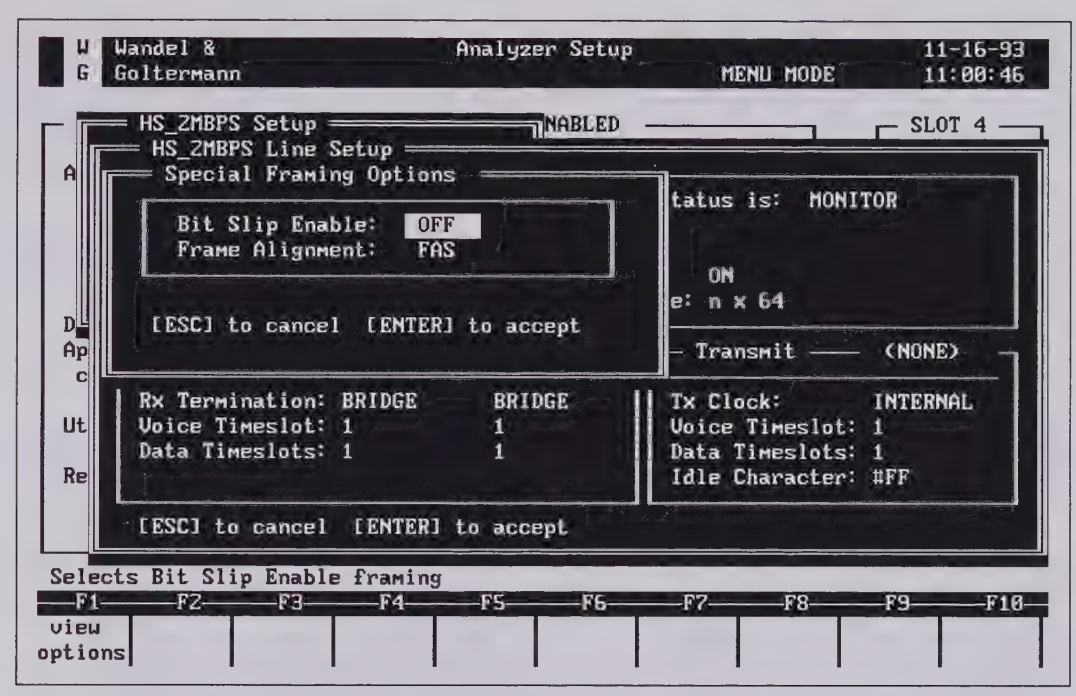


Figure ETSI-23 Alt Framing Menu

ETSI.3.1.1.4.1. Bit Slip Enable

This field allows you to enable an algorithm that allows the receiver to recover from a slip in frame alignment. If the frame alignment signal (FAS) in time slot 0 drifts from the ideal position by up to one bit, the receiver clock immediately realigns itself (Figure ETSI-24). This bit slip is not counted as an FAS error.

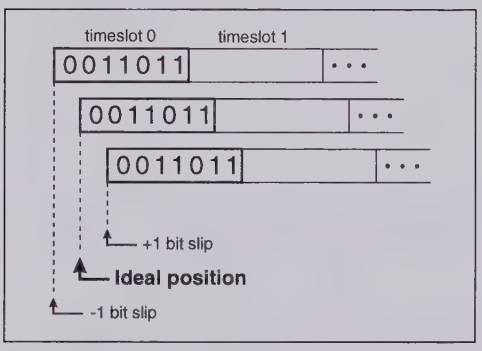


Figure ETSI-24 Bit Slip

The choices are:

- OFF – Disables the bit slip realignment algorithm.
- ON – Enables the bit slip realignment algorithm.

ETSI.3.1.1.4.2. Frame Alignment

This field allows you to specify how the transmitter is to align the Channel-Associated Signaling (CAS) multiframe. The CAS multiframe is shown in Table ETSI-11 in Section 6.3.4.2, "Signaling Bits."

The choices are:

- FAS – The transmitter aligns the CAS multiframe with the FAS in time slot 0 (even frames).
- NFAS – The transmitter aligns the CAS multiframe with the NFAS in time slot 0 (odd frames).

ETSI.3.1.1.5. Line Code

This field shows the line code being used. It is not selectable.

HDB-3 – High Density Bipolar code (as shown in Figure ETSI-16). This code allows a maximum of 3 consecutive zeros to occur in the 2 Mbps bit stream.

ETSI.3.1.1.6. Emulation Status is

This field reports the mode of operation and depends on the setting for Test Function (Table ETSI-1). It is not selectable.

Test Function	Emulation Status
RECEIVE ONLY	Monitor
EMULATION	Emulate
DROP&INS	Emulate

Table ETSI-1 Emulation Status

ETSI.3.1.1.7. Frame CRC

Use this field to determine whether or not a CRC (Cyclical Redundancy Check) calculation is performed **on multiframes**. The CRC-4 method is used.

- ON – a CRC is calculated.
- OFF – a CRC is not calculated.

In the CRC-4 method, a CRC check is performed on blocks of eight consecutive frames (Figure ETSI-23). These blocks are called sub-multiframes (SMF).

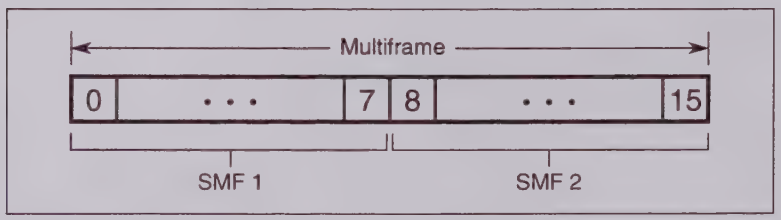


Figure ETSI-25 CRC-4 Method

Each SMF contains 2048 bits (8 x 256 bits). The transmitter multiplies SMF 1 by x^4 and then divides it by the generator polynomial ($x^4 + x + 1$). The resulting check bits (C_1, C_2, C_3 and C_4) are then transmitted in the first bit position of the even numbered frames in the following SMF 2. When SMF 1 is received, the receiver also multiplies and divides it by the same values. The receiver then compares the remainder with the SMF 1 check bits that it receives in SMF 2. If the check bits are different, the checked SMF contains one or more bit errors.

The E bit of frame 13 is used to indicate errors occurring in SMF 1. The E bit of frame 15 is used to indicate errors occurring in SMF 2.

Before the E bits can be used for error indication, you must first enable the Far End Block Error (FEBE) alarm indication system. Press F2 (febe enable) from the Frame CRC softkey rack in order to access the FEBE Alarm Enable menu (Figure ETSI-26).

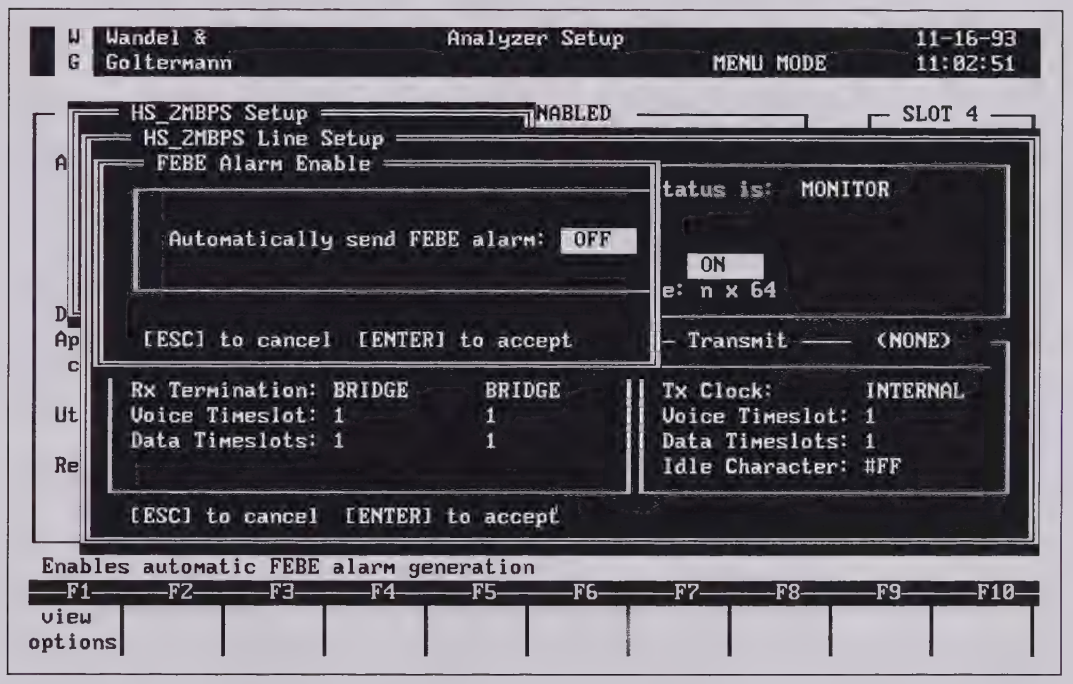


Figure ETSI-26 FEBE Alarm Enable Menu

The choices are:

- OFF – disables the FEBE system.
- ON – enables the FEBE system. The DA-3x automatically sets the appropriate E bit when a CRC-4 block error is detected. This setting is valid only when the Test Function field is set to either EMULATE or DROP&INS and the Frame CRC field (discussed later) is set to ON.

Note:

The CRC method does have limitations. First, multiple errors in a CRC block can lead to the formation of a correct checksum remainder. Second, it is not possible to determine exactly how many errors were the cause of an incorrect checksum remainder.

ETSI.3.1.1.8. Channel Type

This field reports the bit rate being used for the time slots. It is not selectable.

n x 64 kbps – all channels operate at 64 kbps.

ETSI.3.1.2. Receive

Use the Receive section of the 2 Mbps Line Setup menu to set parameters for the two receivers. The Receive section is divided into two columns--one for each receiver. Each of the fields are described in the following sections.

ETSI.3.1.2.1. Rx Termination

Use this field to determine how the receivers are terminated. The termination choices are:

- BRIDGE – The receiver presents a high impedance to the line, so that the 2 Mbps - ETSI Interface does not interfere with traffic. If your application requires that network traffic go undisturbed by the 2 Mbps - ETSI Interface, both receiver terminations should be bridged.
- TERMINATE – The receivers are terminated with a 75 Ω impedance at the W&G Versacon® connector and a 120 W impedance at the LEMO connector.
- MONITOR – The same as the TERMINATE setting. Use this selection when connecting the 2 Mbps - ETSI Interface to the 2 Mbps network via protected monitor jacks. See the Off Line monitoring configuration shown in Figure ETSI-7a (Section 2.4.1, "Monitoring").

ETSI.3.1.2.2. Voice Timeslot (Receive)

Use this field to select the time slot to be used by the handset receiver. Valid entries are 1 to 15 and 17 to 31 if 30 channel framing is used. If 31 channel framing is used, valid entries are 1 to 31. Although you can specify only one channel, you can select different channels for the two receivers. You can also change your channel selections in Run Mode.

ETSI.3.1.2.3. Data Timeslots (Receive)

Use this field to specify the time slots that will make up the data channel being received. You can specify one or more channels. You can specify multiple channels either as a contiguous (e.g. 4, 5, 6 and 7) or as a non-contiguous (e.g. 9, 14 and 17) list. You can specify different time slots for the two receivers.

Enter time slot selections in this field using numbers, commas and dashes as shown in Table ETSI-2.

Entry	Meaning
4	Time Slot 4 is selected
1,2,3	Time Slots 1, 2 and 3 are selected
5,8,12	Time Slots 5, 8 and 12 are selected
1-4	Contiguous Time Slots 1 to 4 inclusive are selected
1--4	Non-contiguous Time Slots from 1 to 4 which are odd-numbered (i.e. 1 and 3) are selected
2--6	Non-contiguous Time Slots from 2 to 6 which are even-numbered (i.e. 2, 4 and 6) are selected

Table ETSI-2 Specifying Time Slots

ETSI.3.1.3. Transmit

Use the Transmit section of the 2 Mbps Line Setup menu to set the parameters for the transmitter. Each of the fields is described in the following sections.

ETSI.3.1.3.1. Tx Clock

This field allows you to specify the source of the transmit clock during emulation. The choices are:

- INTERNAL – the DA-3x provides the transmit clock. Use this setting when the Test Function is set to EMULATE.
- LOOP TIMED – the transmit clock is derived from the incoming bit stream in order to synchronize the Transmitter with the timing on the line. If the Test Function is set to DROP&INS, this selection causes the transmit clock to be derived from the bit stream received on RX1. If the Test Function is set to EMULATE, this selection causes the transmit clock to be derived from the bit stream received on RX2.

ETSI.3.1.3.2. Voice Timeslot (Transmit)

Use this field to select the time slot to be used by the handset for transmitting. Valid entries are 1 to 15 and 17 to 31 if 30 channel framing is used. If 31 channel framing is used, valid entries are 1 to 31. Although you can specify only one time slot, it does not have to be the same time slot on which the handset is receiving. You can change the voice transmit time slot selection in Run Mode.

ETSI.3.1.3.3. Data Timeslots (Transmit)

Use this field to specify the time slots that will make up the data channel being transmitted. You can specify one or more time slots. You can specify multiple time slots either as a contiguous (e.g. 4, 5, 6) or as a non-contiguous (e.g. 9, 14, 17) list.

Enter time slot selections in this field using numbers, commas and dashes as described for the receive data time slots in Section 3.1.2.3, "Data Time Slots (Receive)."

> **Note:**
>
> In addition to data, the 2 Mbps - ETSI Interface can insert Bit Error Ratio Test (BERT) measurement information into channels of the outgoing 2 Mbps bit stream. However, performing BERT requires the use of the BERT_2M Application (included in the Basic ETSI Applications Set).

ETSI.3.1.3.4. Idle Character

Use this field to select the hexadecimal character that will be inserted into an idle time slot during emulation. An idle time slot is defined as a time slot that does not contain data or voice. This field has no effect in the drop and insert mode.

Valid entries are #00 through #FF. The default is #FF.

ETSI.3.2. Data Channel Setup

The Data Channel Setup menu (Figure ETSI-27) allows you to set parameters that specify how the DA-3x treats the data channel within the 2 Mbps pipe. The data channel could represent other protocols such as HDLC and X.25.

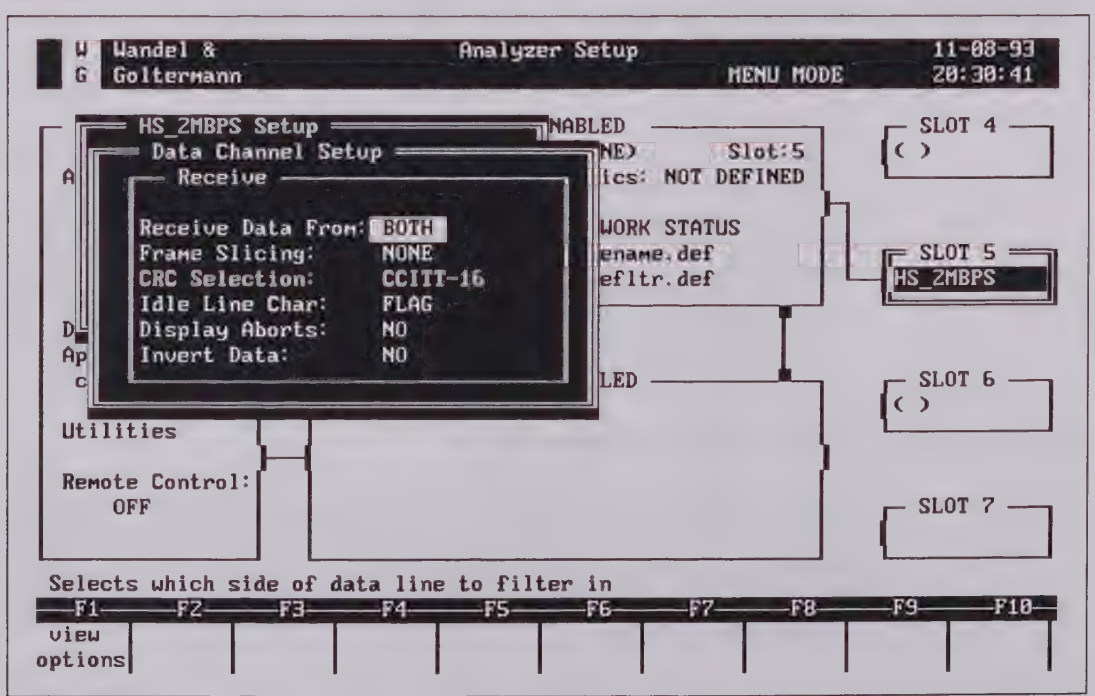


Figure ETSI-27 Data Channel Setup Menu

The following data channel parameters apply to both received and transmitted data.

ETSI.3.2.1. Receive Data From

The received data that is processed by the analyzer can come from either or both receivers. Use this field to make that selection. You can make the following choices:

- BOTH – frames from both RX1 and RX2 are passed to the analyzer for processing.
- RX1 – Only frames from RX1 are passed up to the analyzer for processing.
- RX2 – Only frames from RX2 are passed up to the analyzer for processing.

This field defaults to BOTH.

ETSI.3.2.2. Frame Slicing

Use this field to shorten a data frame before it is passed to the Protocol Analyzer for processing. This is useful when you are only interested in certain parts of a frame (i.e. frame headers). The choices are:

- NONE – The entire frame is passed.
- 32 – Only the first 32 bytes of a frame are passed.
- 64 – Only the first 64 bytes of a frame are passed.
- 128 – Only the first 128 bytes of a frame are passed.
- 256 – Only the first 256 bytes of a frame are passed.
- 512 – Only the first 512 bytes of a frame are passed.
- 1024 – Only the first 1024 bytes of a frame are passed.

> **Note:**
>
> Be careful not to slice a data frame in the middle of a protocol header. This makes the protocol invalid for decoding.

Although no data beyond the specified number of bytes is passed to the protocol analyzer, CRC checking is performed on the entire frame. This field defaults to NONE.

ETSI.3.2.3. CRC Selection

Use this field to select the type of CRC checking that is being used on the data channel. Your selection here does not affect the CRC calculation performed by the 2 Mbps equipment (CRC-4). The choices are:

- CCITT-16 – calculates the CRC using the CCITT-16 polynomial ($x^{16} + x^{15} + x^2 + 1$).
- CRC-32 – calculates the CRC using the CRC-32 polynomial ($x^{32} + x^{26} + x^{23} + x^{22} + x^{16} + x^{12} + x^{11} + x^{10} + x^8 + x^7 + x^5 + x^4 + x^2 + x + 1$).
- NONE – no CRC is performed.

The default type is CCITT-16.

ETSI.3.2.4. Idle Line Character

Use this field to select the character that the receivers interpret as an idle line (no data being transmitted).

- FLAG – Sets the Idle Line Character to 7E (hex).
- MARK – Sets the Idle Line Character to FF (hex).

The default is FLAG.

ETSI.3.2.5. Display Abort

Use this field to select whether or not Aborted frames trigger a specific event in the Network Event Program.

- NO
- YES

This field defaults to NO.

ETSI.3.2.6. Invert Data

Use this field to specify whether or not data in the data channel is inverted. The choices are:

- YES
- NO

The default is NO.

ETSI.3.3. Voice Channel Setup

The Voice Channel Setup menu (Figure ETSI-28) allows you to set the initial parameters of the voice channel on the 2 Mbps - ETSI Interface.

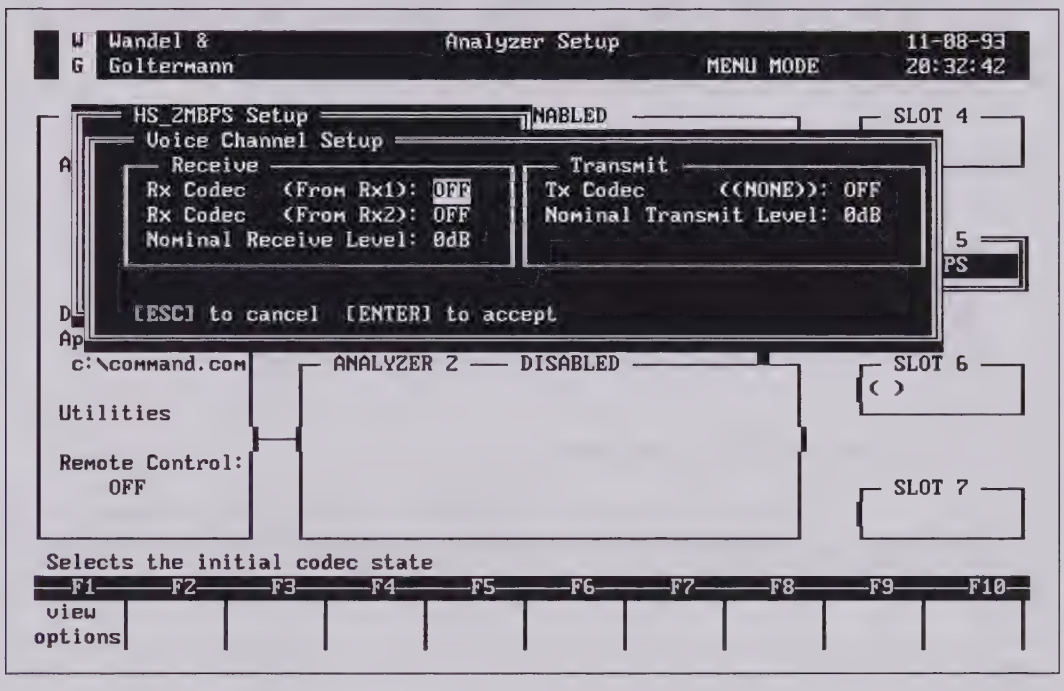


Figure ETSI-28 Voice Channel Setup Menu

Analog voice signals are converted to digital (PCM) signals, and digital voice signals are converted to analog via a device called a Codec (Coder/Decoder). The transmitter has an associated coder, and each receiver has an associated decoder. All codecs use A-law encoding/decoding.

This menu allows you to separately set up the coder and each decoder.

ETSI.3.3.1. Rx Codec (From RX1)

Use this field to set the initial state of the decoder for Receiver 1.

- ON – the decoder is enabled when the DA-3x enters Run Mode.
- OFF – the decoder is disabled when the DA-3x enters Run Mode.

You can turn the decoder ON and OFF in Run Mode.

ETSI.3.3.2. Rx Codec (From RX2)

Use this field to set the initial state of the decoder for Receiver 2.

- ON – the decoder is enabled when the DA-3x enters Run Mode.
- OFF – the decoder is disabled when the DA-3x enters Run Mode.

You can also turn the decoder ON and OFF in Run Mode.

ETSI.3.3.3. Nominal Receive Level

Use this field to adjust the relative level (volume) of the received voice signal. The default level is 0 dB. You can increase the level to +10 dB or decrease it to -10 dB in 1 dB steps.

You can also adjust the receive level in Run Mode.

ETSI.3.3.4. Tx Codec

Use this field to set the initial state of the transmitter's coder.

- ON – the coder is enabled when the DA-3x enters Run Mode.
- OFF – the coder is disabled when the DA-3x enters Run Mode.

You can also turn the coder ON and OFF in Run Mode.

ETSI.3.3.5. Nominal Transmit Level

Use this field to adjust the relative level (volume) of the transmitted voice signal. The default level is 0 dB. You can increase the level to +10 dB or decrease it to -10 dB in 1 dB steps.

You can also adjust the transmit level in Run Mode.

ETSI.4. Consistency Check In TESTPREP Mode

After you have the completed the interface setup (2 Mbps Line Setup, Data Channel Setup, and Voice Channel Setup) and returned to the DA-3x Main Menu, you can run your current application by going to Run Mode (press Alt-Run). Before going from Menu Mode to Run Mode, the DA-3x runs a program called TESTPREP. TESTPREP checks to see if all your setup entries are consistent before compiling and running your application. If you have inadvertently created an inconsistent setup, TESTPREP flags the problem. A warning message appears (Figure ETSI-26) and offers you the option of returning to Menu Mode to correct the inconsistent settings or allowing the DA-3x to change them for you. If you choose the latter, the change takes effect in Run Mode only; that is, the menu selection is not physically altered. Running the application again **without** making the necessary correction(s)

in the setup menus produces the same results. Therefore, upon seeing the warning message, you may want to return to Menu Mode, correct the inconsistency, and save the application before running it again.

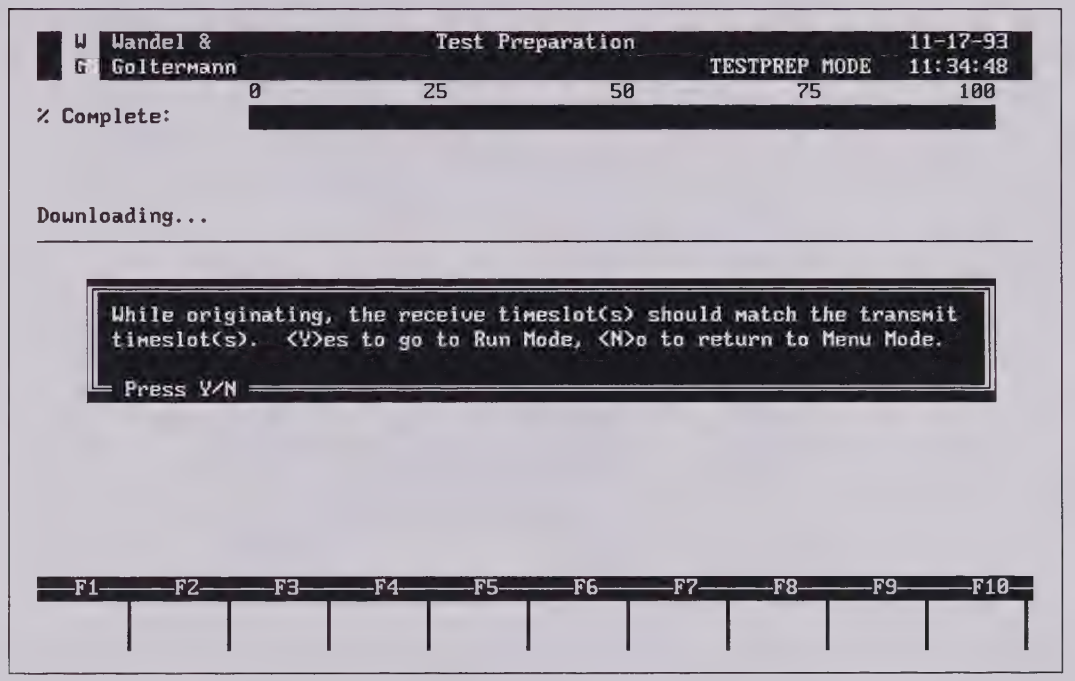


Figure ETSI-29 TESTPREP Warning

ETSI.5. 2 Mbps LED Indicators

There are 12 front panel LEDs that provide real-time network status and alarm conditions. An LED overlay (Figure ETSI-30) associates a special meaning with each LED.

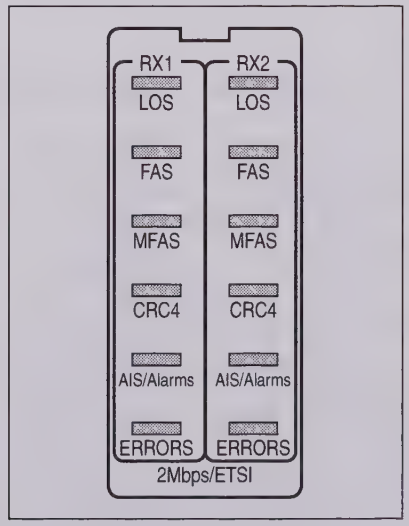


Figure ETSI-30 2 Mbps LED Overlay

The left bank (RX1) of LEDs reports on Receiver 1 when operating in the Monitor or Drop and Insert modes. It reports on the transmitter when in the emulate mode. The right bank (RX2) of LEDs reports on Receiver 2. The LEDs provide status as follows:

- LOS – indicates when the 2 Mbps line signal is no longer being detected (Table ETSI-3). Loss of signal occurs whenever 175 consecutive zeros are received.

LED	Meaning
Red	2 Mbps signal has been lost.
OFF	2 Mbps signal is present.

Table ETSI-3 LOS LED

- FAS – indicates when frame alignment signal framing has been achieved (Table ETSI-4).

LED	Meaning
Green	FAS framing is present.
OFF	FAS framing is not present.

Table ETSI-4 FAS LED

- MFAS – indicates when multi-frame alignment signal framing has been achieved (Table ETSI-5).

LED	Meaning
Green	MFAS framing is present.
OFF	MFAS framing is not present.

Table ETSI-5 MFAS LED

- CRC4 – indicates when CRC-4 framing has been achieved (Table ETSI-6).

LED	Meaning
Green	CRC-4 framing has been achieved.
OFF	CRC-4 framing (Frame CRC) is not enabled on the 2 Mbps Line Setup menu.
Red	CRC-4 framing is enabled but has not been achieved.

Table ETSI-6 CRC4 LED

- AIS/ALARMS – indicates when an Alarm Indication Signal (an all-ones condition) is detected or when another alarm condition occurs (Table ETSI-7). Examples of alarm conditions are Remote Alarm Indication and LOF.

LED	Meaning
Red	AIS/Alarms are occurring.
Orange	AIS/Alarms have occurred.

Table ETSI-7 AIS/ALARMS LED

- ERRORS – indicates that one or more errors have occurred (Table ETSI-8). The following errors will cause this LED to illuminate: HDB-3 code errors, CRC-4 errors, No Frame (LOF) errors, FAS errors and MFAS errors.

LED	Meaning
Red	Errors are occurring.
Orange	Errors have occurred.

Table ETSI-8 ERRORS LED

Note:

In the case of the AIS/ALARM and the ERRORS LEDs, a history is preserved. For these, the LED is red for the duration of the alarm. However, when the alarm/error condition clears, the LED turns orange to indicate that the alarm has occurred (but is no longer occurring). The LED History can be cleared by pressing the CLR LED HISTORY softkey in Run Mode. This turns the LED off.

ETSI.6. Viewing Results in Run Mode

The 2 Mbps - ETSI Interface software (LIP) offers four screens in Run Mode that report network status and statistics. These screens are:

- 2 Mbps Summary
- 2 Mbps Detail
- Voice Summary
- 2 Mbps NFAS Summary

These screens are accessed via the Network Status softkey rack. To reach the Network Status softkey rack, press F1 (network status).

In addition to the 2 Mbps status screens, you can display the protocol traces of any higher-layer protocol packages that are loaded and active in the current application. You can access these Protocol Trace screens by pressing F3 (protocol traces) from the Run Mode Top Rack.

ETSI.6.1. The 2 Mbps Summary Screen

This screen displays a summary of the network statistics and error conditions. To access the 2 Mbps Summary screen, press F1 (2 Mbps SUMMARY) from the Network Status softkey rack. A sample 2 Mbps Summary screen is shown in Figure ETSI-31.

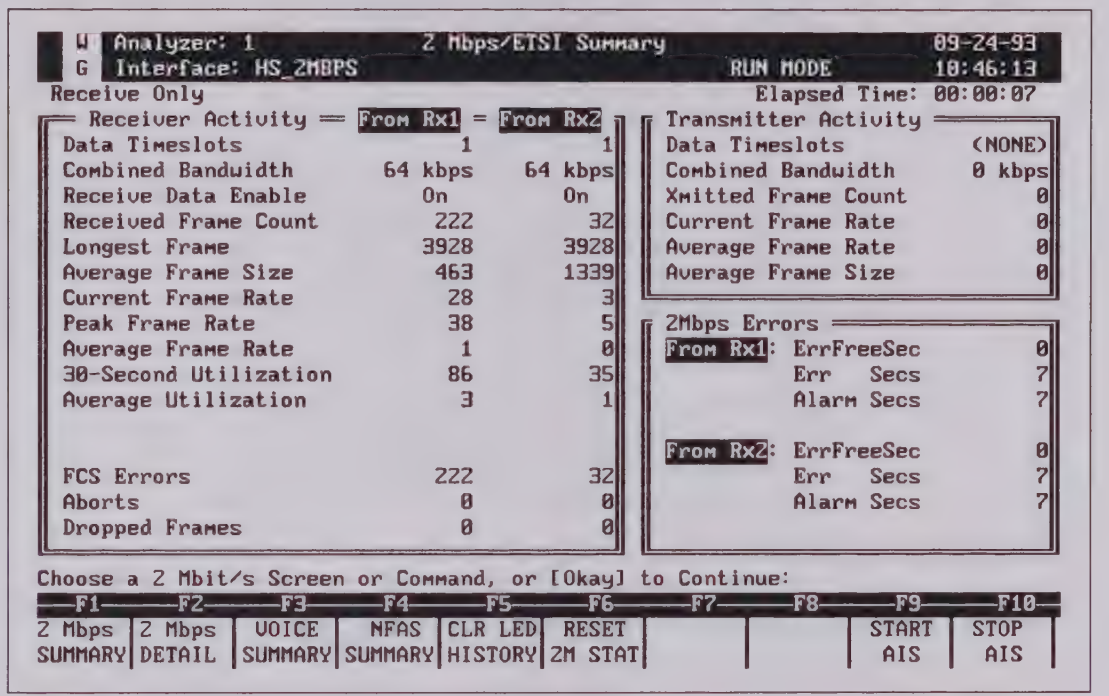


Figure ETSI-31 2 Mbps Summary Screen

The screen header displays the current Test Function setting and the Elapsed Time. This screen is divided into the following three sections:

- Receiver Activity
- Transmitter Activity
- 2 Mbps Errors

ETSI.6.1.1. Receiver Activity

The Receiver Activity section reports data statistics for the receiver. This section is divided into two columns—one for each receiver. Receiver 1 information is reported in the first column (RX1), and Receiver 2 information is reported in the second column (RX2). The RX2 column always reports the data statistics derived from the received bit stream at the RX2 port. What is reported in the RX1 column depends on the Test Function setting. For instance, if the Test Function is set to RECEIVE ONLY, the RX1 column reports statistics derived from the bit stream received at the RX1 port. If the Test Function is set to EMULATE, the RX1 column reports data statistics derived from the bit stream generated by the transmitter. If the Test Function is set to DROP&INS, the RX1 column reports statistics derived from the bit stream generated by the transmitter after the drop and insert process has taken place.

For each receiver, the Receiver Activity section displays:

- Data Time slots – the selected data time slots that make up the data channel being received. These time slots are specified on the 2 Mbps Line Setup menu.

- Combined Bandwidth – the combined bandwidth of the time slots that make up the data channel being received.

The following counters pertain to the selected data time slots (not the total 2 Mbps pipe).

- Receive Data Enable – the On/Off status of the receiver. This field gets its information from the Receive Data From setting on the Data Channel Setup menu (Table ETSI-9).

Receive Data From Setting	**Receive Data Enable** Status	
	RX1	**RX2**
RX1	On	Off
RX2	Off	On
BOTH	On	On

Table ETSI-9 Receive Data Enable Status Indicators

- Received Frame Count – The total number of frames received.
- Longest Frame – the size (in bytes) of the longest frame that has been received since entering Run Mode.
- Average Frame Size – the average size (in bytes) of the frames received since entering Run Mode.
- Current Frame Rate – the frame rate (frames per second) detected at the receiver.
- Peak Frame Rate – the highest frame rate (frames per second) detected at the receiver since entering Run Mode.
- Average Frame Rate – the average frame rate (frames per second) detected at the receiver.
- 30-Second Utilization – the average utilization (% of maximum bits) for the past 30-second interval. This field is a "sliding-window" that is updated every second. During the first 30 seconds after entering Run Mode, this value is the average utilization for that period.
- Average Utilization – the average utilization (% of maximum bits) since entering Run Mode.
- FCS Errors – the number of Frame Check Sequence errors that have occurred .
- Aborts – the number of Abort conditions that have occurred. An Abort is defined to be the receipt of seven consecutive one (1) bits.
- Dropped Frames – the number of frames received by the line interface that the DA-3x could not accept for processing.

ETSI.6.1.2. Transmitter Activity

The Transmitter Activity section reports data statistics for the transmitter. If the transmitter is enabled, the Transmitter Activity section reports the following:

- Data Time slots – the selected data time slots that make up the data channel being transmitted. These time slots are specified on the 2 Mbps Line Setup menu.

  If Test Function is set to RECEIVE ONLY, this field displays NONE.

- Combined Bandwidth – the combined bandwidth of the time slots that make up the data channel being transmitted.
- Xmitted Frame Count – the current number of data frames that have been transmitted.
- Current Frame Rate – the frame rate (frames per second) at which frames are being transmitted.
- Average Frame Rate – the average rate (frames per second) at which frames are being transmitted.
- Average Frame Size – the average size (in bytes) of the transmitted frames since entering Run Mode.

ETSI.6.1.3. 2 Mbps Errors

The 2 Mbps Errors section reports an abbreviated version of the error and alarm statistics for the total 2 Mbps pipe. For each receiver, the following statistics are reported:

- ErrFreeSec – Error Free Seconds reports the number of one-second time intervals that contain no errors (e.g. code errors, CRC4 errors, FAS errors, etc).
- Err Secs – Errored Seconds reports the number of one-second time intervals that contained one or more errors (e.g. code errors, CRC4 errors, FAS errors, etc).
- Alarm Secs – Alarm Seconds reports the number of one-second time intervals in which one or more of the following alarm conditions occurred: Alarm Indication Signal (AIS), Remote Alarm Indication (RAI), No Signal (LOS) or No Frame (LOF).

ETSI.6.2. 2 Mbps Detail Screen

Figure ETSI-32 shows a sample 2 Mbps Detail screen. This screen reports a more detailed version of error and alarm statistics for the total 2 Mbps pipe.

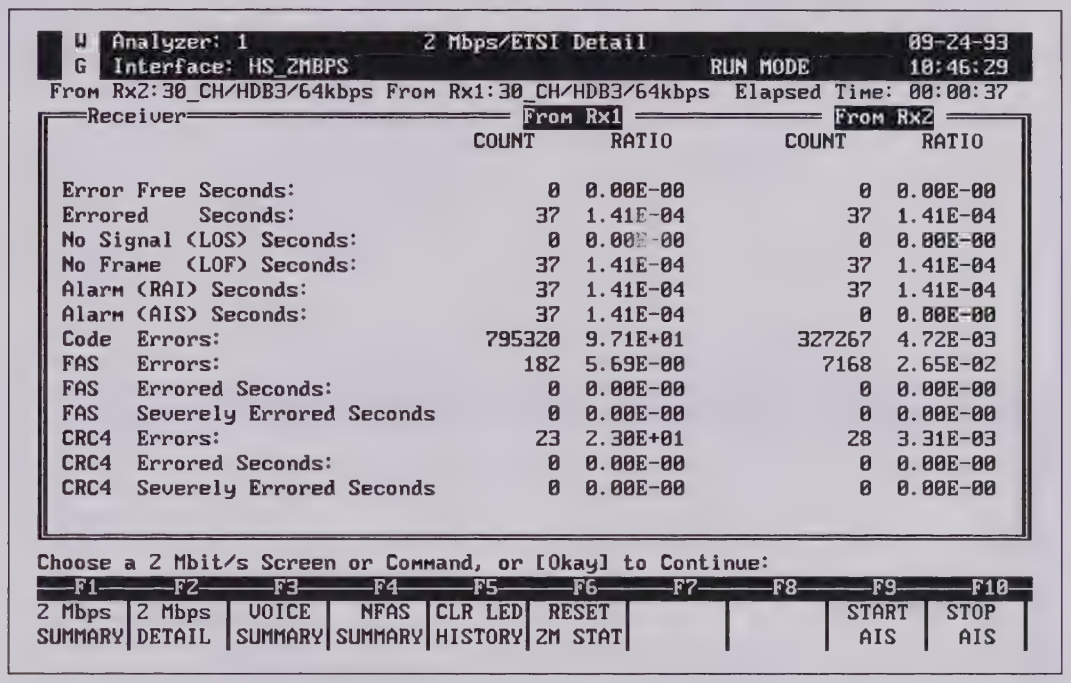

W Analyzer: 1 2 Mbps/ETSI Detail 09-24-93
G Interface: HS_2MBPS RUN MODE 10:46:29
From Rx2:30_CH/HDB3/64kbps From Rx1:30_CH/HDB3/64kbps Elapsed Time: 00:00:37
Receiver From Rx1 From Rx2
COUNT RATIO COUNT RATIO
Error Free Seconds: 0 0.00E-00 0 0.00E-00
Errored Seconds: 37 1.41E-04 37 1.41E-04
No Signal (LOS) Seconds: 0 0.00E-00 0 0.00E-00
No Frame (LOF) Seconds: 37 1.41E-04 37 1.41E-04
Alarm (RAI) Seconds: 37 1.41E-04 37 1.41E-04
Alarm (AIS) Seconds: 37 1.41E-04 0 0.00E-00
Code Errors: 795320 9.71E+01 327267 4.72E-03
FAS Errors: 182 5.69E-00 7168 2.65E-02
FAS Errored Seconds: 0 0.00E-00 0 0.00E-00
FAS Severely Errored Seconds 0 0.00E-00 0 0.00E-00
CRC4 Errors: 23 2.30E+01 28 3.31E-03
CRC4 Errored Seconds: 0 0.00E-00 0 0.00E-00
CRC4 Severely Errored Seconds 0 0.00E-00 0 0.00E-00
Choose a 2 Mbit/s Screen or Command, or [Okay] to Continue:
F1 2 Mbps SUMMARY
F2 2 Mbps DETAIL
F3 VOICE SUMMARY
F4 NFAS SUMMARY
F5 CLR LED HISTORY
F6 RESET 2M STAT
F7
F8
F9 START AIS
F10 STOP AIS

Figure ETSI-32 2 Mbps Detail Screen

The screen header shows the type of framing, line code and channel type for each receiver. The rest of the screen is divided into two columns—one for each receiver. In each column, the statistics are reported as a count value and as a ratio. The ratios are displayed in scientific notation, and the basis for the ratio calculation is explained with each statistic.

Table ETSI-10 lists the error and alarm statistics that are reported.

Status Field	Count	Ratio
Error Free Seconds	number of one-second time intervals that contained no errors.	Error-Free Seconds divided by the total number of seconds that have elapsed since entering Run Mode or resetting the statistics.
Errored Seconds	number of one-second time intervals that contained one or more errors.	Errored Seconds divided by the total number of seconds that have elapsed since entering Run Mode or resetting the statistics.
No Signal (LOS) Seconds	number of one-second time intervals in which the received signal is either too low or not present (175 or more consecutive zeros received).	No Signal Seconds divided by the total number of seconds that have elapsed since entering Run Mode or resetting the statistics.

Status Field	Count	Ratio
No Frame (LOF) Seconds	number of one-second intervals in which the receiver has been out of frame (caused by two out of four consecutive framing bits being in error during a 3 millisecond period).	No Frame Seconds divided by the total number of seconds that have elapsed since entering Run Mode or resetting the statistics.
Alarm (RAI) Seconds	number of one-second intervals containing a remote alarm indication.	Alarm (RAI) Seconds divided by the total number of seconds that have elapsed since entering Run Mode or resetting the statistics.
Alarm (AIS) Seconds	number of one-second intervals containing an alarm indication signal.	Alarm (AIS) Seconds divided by the total number of seconds that have elapsed since entering Run Mode or resetting the statistics.
Code Errors	number of HDB-3 code violations	Code Errors divided by the number of code errors possible in a second.
FAS Errors	number of frame alignment errors.	FAS Errors divided by the number of FAS errors possible in a second.
FAS Errored Seconds	number of one-second time intervals containing a frame alignment errors.	FAS Errored Seconds divided by the total number of seconds that have elapsed since entering Run Mode or resetting the statistics.
FAS Severely Errored Seconds	number of one-second time intervals where the FAS Error Ratio exceeds 1×10^{-3}.	FAS Severely Errored Seconds divided by the total number of seconds that have elapsed since entering Run Mode or resetting the statistics.
CRC4 Errors	number of CRC4 errors.	CRC4 Errors divided by the number of CRC4 errors possible in a second.
CRC4 Errored Seconds	number of one-second time intervals containing a CRC4 error.	CRC4 Errored Seconds divided by the total number of seconds that have elapsed since entering Run Mode or resetting the statistics.

Status Field	Count	Ratio
CRC4 Severely Errored Seconds	number of one-second time intervals where the CRC4 Error Ratio exceeds 1×10^{-3}.	CRC4 Severely Errored Seconds divided by the total number of seconds that have elapsed since entering Run Mode or resetting the statistics.

Table ETSI-10 2 Mbps Error & Alarm Statistics

ETSI.6.3. The Voice Summary Screen

Figure ETSI-33 shows a sample Voice Summary screen.

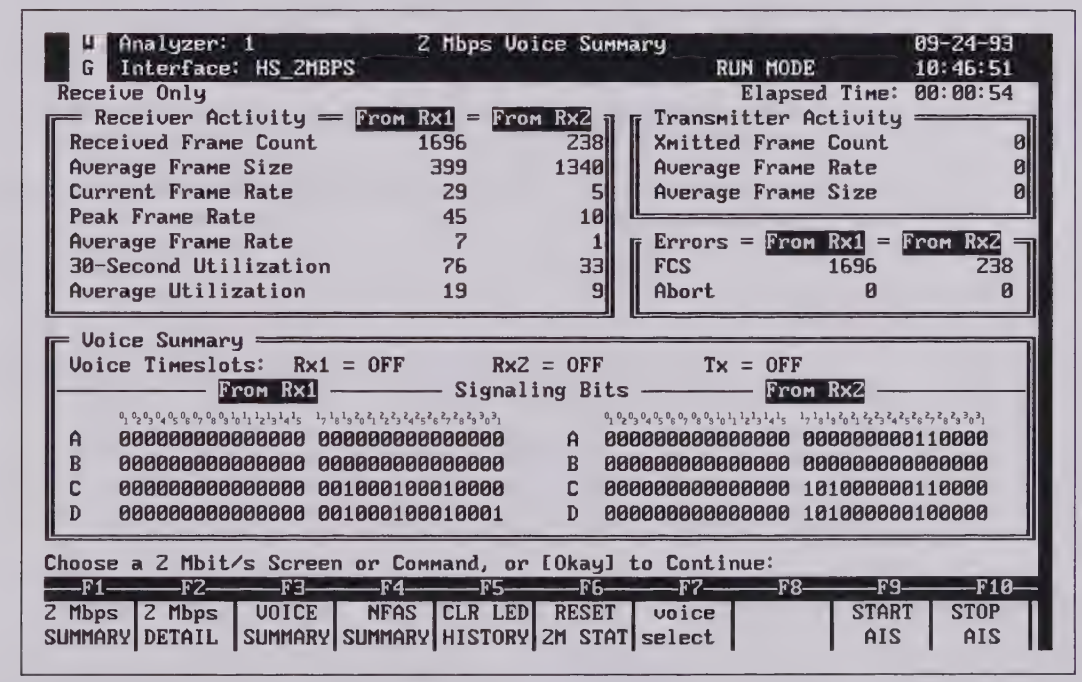

U Analyzer: 1 2 Mbps Voice Summary 09-24-93
G Interface: HS_2MBPS RUN MODE 10:46:51
Receive Only Elapsed Time: 00:00:54
Receiver Activity From Rx1 From Rx2
Received Frame Count 1696 238
Average Frame Size 399 1340
Current Frame Rate 29 5
Peak Frame Rate 45 10
Average Frame Rate 7 1
30-Second Utilization 76 33
Average Utilization 19 9
Transmitter Activity
Xmitted Frame Count 0
Average Frame Rate 0
Average Frame Size 0
Errors From Rx1 From Rx2
FCS 1696 238
Abort 0 0
Voice Summary
Voice Timeslots: Rx1 = OFF Rx2 = OFF Tx = OFF
From Rx1 Signaling Bits From Rx2
A 000000000000000 000000000000000 A 000000000000000 000000000110000
B 000000000000000 000000000000000 B 000000000000000 000000000000000
C 000000000000000 001000100010000 C 000000000000000 101000000110000
D 000000000000000 001000100010001 D 000000000000000 101000000100000
Choose a 2 Mbit/s Screen or Command, or [Okay] to Continue:
F1 2 Mbps SUMMARY
F2 2 Mbps DETAIL
F3 VOICE SUMMARY
F4 NFAS SUMMARY
F5 CLR LED HISTORY
F6 RESET 2M STAT
F7 voice select
F8
F9 START AIS
F10 STOP AIS

Figure ETSI-33 Voice Summary Screen

The screen header displays the Test Function and the Elapsed Time. The rest of the screen is divided into four sections: Receiver Activity, Transmitter Activity, Errors and Voice Summary.

ETSI.6.3.1. Receiver Activity

The Receiver Activity section reports data statistics for the receiver. It is an abbreviated version of the Receiver Activity section of the 2 Mbps Summary screen.

For each receiver, the following data statistics are reported:

- Received Frame Count – The total number of frames received.
- Average Frame Size – the average size (in bytes) of the frames received since entering Run Mode.
- Current Frame Rate – the frame rate (frames per second) detected at the receiver.

- Peak Frame Rate – the highest frame rate (frames per second) detected at the receiver since entering Run Mode.
- Average Frame Rate – the average frame rate (frames per second).
- 30 Second Utilization – the average utilization (% of maximum bits) for the past 30-second interval. This field is a "sliding-window" that is updated every second. During the first 30 seconds after entering Run Mode, this value is the average utilization for that period.
- Average Utilization – the average utilization (% of maximum bits) since entering Run Mode.

ETSI.6.3.2. Transmitter Activity

The Transmitter Activity section reports data statistics for the transmitter. It is an abbreviated version of the Transmitter Activity section of the 2 Mbps Summary screen. If the transmitter is enabled, the Transmitter Activity section reports the following data statistics:

- Xmitted Frame Count – the current number of data frames that have been transmitted.
- Average Frame Rate – the average rate (frames per second) at which frames are being transmitted.
- Average Frame Size – the average size (in bytes) of the transmitted frames since entering Run Mode.

ETSI.6.3.3. Errors

The Errors section reports the following two data errors that are from the Receiver Activity section of the 2 Mbps Summary screen:

FCS – the number of Frame Check Sequence errors that have occurred .

Abort – the number of Abort conditions that have occurred. An Abort is defined to be the receipt of seven consecutive one (1) bits.

ETSI.6.3.4. Voice Summary

The Voice Summary section displays the voice time slot selection. If the 30 Channel framing system is being used, the status of the signaling bits (time slot 16) is also reported for both receivers. If the 31 Channel framing system is being used, no signaling bits are displayed.

ETSI.6.3.4.1. Voice Timeslots

As with data, the 2 Mbps - ETSI Interface can receive voice on two channels and transmit on one. The Voice Timeslots field displays the number of the time slot that is used for Receiver 1 (RX1), Receiver 2 (RX2) and the Transmitter (TX). If the corresponding codec is disabled, OFF is displayed instead.

ETSI.6.3.4.2. Signaling Bits

Time slot 16 of the 2 Mbps frame is used for Channel-Associated Signaling (CAS). The information necessary for switching and routing the 30 voice/data time slots is interleaved and transmitted in a multiframe using this time slot. Figure ETSI-34 shows how time slot 16 is sub-divided into two groups of four bits which are given letter designations (A to D).

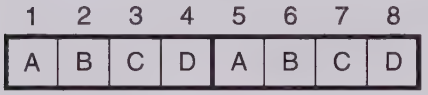


Figure ETSI-34 Signaling Bits of Time slot 16

Table ETSI-11 shows the time slot assignment of these signaling bits within a multiframe.

Frame	Bits in Time Slot 16							
#	A	B	C	D	A	B	C	D
1	Time Slot 1				Time Slot 16			
2	Time Slot 2				Time Slot 17			
3	Time Slot 3				Time Slot 18			
4	Time Slot 4				Time Slot 19			
5	Time Slot 5				Time Slot 20			
6	Time Slot 6				Time Slot 21			
7	Time Slot 7				Time Slot 22			
8	Time Slot 8				Time Slot 23			
9	Time Slot 9				Time Slot 24			
10	Time Slot 10				Time Slot 25			
11	Time Slot 11				Time Slot 26			
12	Time Slot 12				Time Slot 27			
13	Time Slot 13				Time Slot 28			
14	Time Slot 14				Time Slot 29			
15	Time Slot 15				Time Slot 30			

Table ETSI-11 Channel Assignment of Signaling Bits

The numbers across the top of the Signaling Bits field correspond to the time slots. The letter designations (A, B, C and D) correspond to the signaling channels.

When interpreting the Signaling Bits field, read the signaling bits from top (A) to bottom (D) for a given time slot number.

If the time slot is not being used for data instead of voice, the bits shown correspond to their actual values in these positions in the bit stream. On an idle channel, the bit is set to 1—corresponding to the least significant bit of FF (hex) which is the usual Idle Line character.

ETSI.6.3.5. Voice Select Softkey Commands

A set of commands that provide voice support (via the RJ-11 handset port) are available on the Voice Select softkey rack shown in Figure ETSI-35. To access the Voice Select softkey rack, press F7 (voice select) from the Voice Summary softkey rack. These commands allow you to:

- select one of the two receivers for monitoring with the handset
- enable/disable the codec associated with a receiver
- enable/disable the transmit codec
- change the time slot accessed by a codec
- adjust a codec's volume

Figure ETSI-35 Voice Select Softkey Rack

ETSI.6.3.5.1. Selecting the Codec

A codec must first be selected before its parameters can be modified. The following three softkeys allow you to select one of the codecs. The prompt line (above the softkey rack) identifies the codec that is selected.

- RX2 (F1) – Selects the Receiver 2 codec. When F1 is pressed, the softkey name disappears from the rack and appears in the prompt line.
- RX1 (F2) – Selects the Receiver 1 codec. When F2 is pressed, the softkey name disappears from the rack and appears in the prompt line.
- TX (F3) – Selects the Transmitter codec. When F3 is pressed, the softkey name disappears from the rack and appears in the prompt line. This softkey is available only when the Test Function is set to EMULATE or DROP&INS.

ETSI.6.3.5.2. Changing the Time Slot

After selecting and enabling a codec, you can change its associated time slot (if enabled). The following two softkeys allow you to change the associated time slot. The associated time slot can also be initially set on the 2 Mbps Line Setup menu.

- Channel ↑ (F5) – The time slot number is incremented by one. Numbering wraps around to time slot 1 after time slot 31 has been reached.
- Channel ↓ (F6) – The time slot number is decremented by one. Numbering wraps around to time slot 31 after time slot 1 has been reached.

Note:

Be careful when changing time slots in Run Mode. If you insert voice into a time slot that is already being used for data, the data in that time slot is corrupted.

ETSI.6.3.5.3. Adjusting the Volume

The following two softkeys allow you to adjust the volume level on the selected voice time slot. The volume level can also be set initially on the Voice Channel Setup menu. The default volume level for the transmit and both receive codecs is 0 dB (considered a comfortable listening level).

- Volume ↑ (F7) – Increases the volume level in 1 dB steps up to +10 dB.
- Volume ↓ (F8) – Decreases the volume level in 1 dB steps down to -10 dB.

ETSI.6.3.5.4. Enabling/Disabling the Codec

After selecting a codec, you can enable or disable it. The following two softkeys allow you to enable and disable a codec. The codecs can also be enabled or disabled on the Voice Channel Setup menu.

- ON (F9) – Enables the selected codec.
- OFF (F10) – Disables the selected codec.

ETSI.6.4. The 2 Mbps NFAS Summary Screen

Figure ETSI-36 shows the 2 Mbps NFAS Summary screen. This screen provides a detailed look at time slot 0 of NFAS (odd numbered) frames. For each receiver, the status of the E and Sa bits of time slot 0 is displayed. These bits are only valid when CRC-4 is being used.

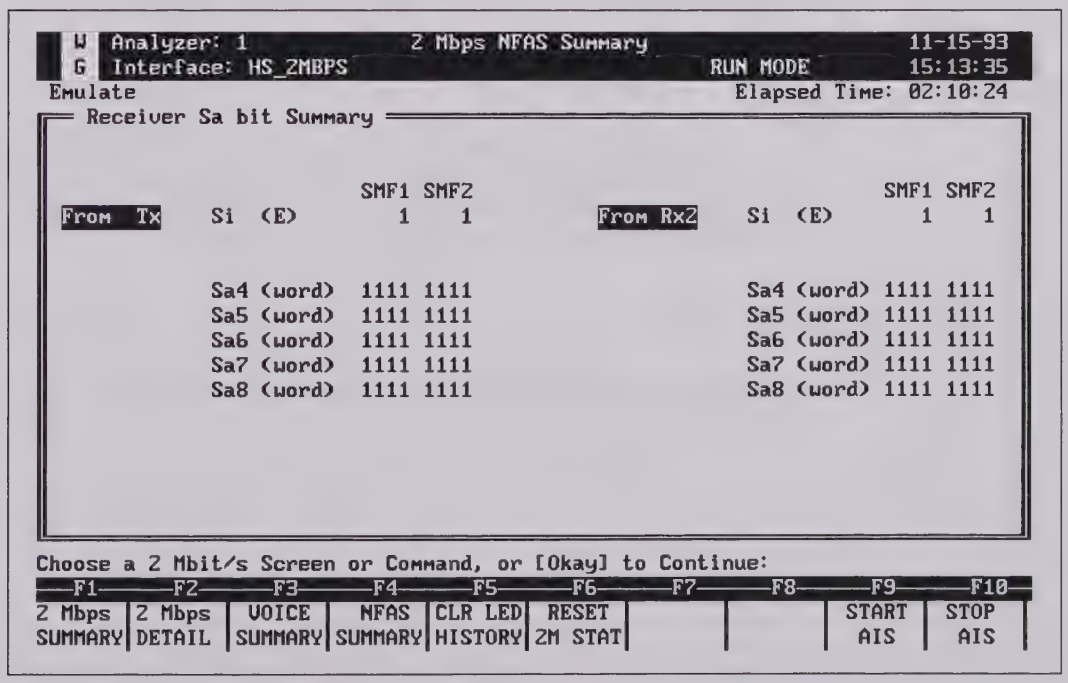

W Analyzer: 1 2 Mbps NFAS Summary 11-15-93
G Interface: HS_2MBPS RUN MODE 15:13:35
Emulate Elapsed Time: 02:10:24
Receiver Sa bit Summary
From Tx Si (E) SMF1 1 SMF2 1
From Rx2 Si (E) SMF1 1 SMF2 1
Sa4 (word) 1111 1111
Sa5 (word) 1111 1111
Sa6 (word) 1111 1111
Sa7 (word) 1111 1111
Sa8 (word) 1111 1111
Sa4 (word) 1111 1111
Sa5 (word) 1111 1111
Sa6 (word) 1111 1111
Sa7 (word) 1111 1111
Sa8 (word) 1111 1111
Choose a 2 Mbit/s Screen or Command, or [Okay] to Continue:
F1 2 Mbps SUMMARY
F2 2 Mbps DETAIL
F3 VOICE SUMMARY
F4 NFAS SUMMARY
F5 CLR LED HISTORY
F6 RESET 2M STAT
F7
F8
F9 START AIS
F10 STOP AIS

Figure ETSI-36 2 Mbps NFAS Summary Screen

The screen header displays the Test Function and the Elapsed Time. The rest of the screen is divided into two sections. The left section is for RX1 (or TX), and the right section is for RX2.

Each section is organized into 2 columns: SMF1 and SMF2. The first row of these columns displays the E bit status. The bit underneath the SMF1 heading indicates whether an error

occurred in submultiframe 1. The bit underneath the SMF2 heading indicates whether an error occurred in submultiframe 2.

The next 5 rows are called Sa words. Each Sa word is organized into 2 groups of 4 bits. The first group represents (from left to right) the Sa bits taken from frames 1, 3, 5 and 7 of submultiframe 1. The second group represents (from left to right) the Sa bits taken from frames 9, 11, 13 and 15 of submultiframe 2.

ETSI.6.5. Network Status Softkey Commands

The Network Status softkey rack also supports the following softkey commands in Run Mode:

- CLR LED HISTORY (F5)
- RESET 2M STAT (F6)
- START AIS (F9)
- STOP AIS (F10)

These commands are available when viewing any of the Network Status screens.

ETSI.6.5.1. CLR LED HISTORY (F5)

This softkey allows you to clear an LED history. The AIS/ALARMS and ERRORS LEDs have both an "active" and "history" state. For instance, if HDB-3 code errors have occurred, but are no longer occurring, the ERRORS LED changes from red to orange to preserve the LED history. By pressing F5, you clear the history by turning the LED off.

ETSI.6.5.2. RESET 2M STAT (F6)

This softkey allows you to reset all statistical displays that pertain to the 2 Mbps pipe. This includes the 2 Mbps Errors statistics on the 2 Mbps Summary screen and all statistics on the 2 Mbps Detail screen. New measurements begin immediately. The DA-3x's Elapsed Time field is not reset. No other data and voice statistics are affected.

ETSI.6.5.3. START AIS (F9)

This softkey allows you to start the transmission of an Alarm Indication Signal (AIS).

ETSI.6.5.4. STOP AIS (F10)

This softkey allows you to stops the transmission of an AIS that was started by pressing F9. If the transmitter is not sending an AIS, pressing this softkey has no effect.

ETSI.7. Viewing Results in Examine Mode

Examine Mode offers the same Network Status screens that are available in Run Mode. These are the 2 Mbps Summary, 2 Mbps Detail and Voice Summary screens. These screens are reached by pressing F1 (network status) from the Examine Mode Top Rack. If you enter Examine Mode from Run Mode, the 2 Mbps - ETSI Interface continues to perform the same Test Function that it did in Run Mode. The 2 Mbps framing and signaling continue without interruption. However the Voice Select softkey commands (on the Voice Summary softkey rack) and the Network Status softkey commands (on the Network Status softkey rack) are not available. Therefore, although you could continue to use the handset connection on an enabled voice time slot in Examine Mode, you cannot change the channel or adjust the volume.

There are no find commands specific to the 2 Mbps - ETSI Interface.

ETSI.8. Technical Specifications

The 2 Mbps - ETSI Interface enables the DA-3x to test networks that comply to the following standards:

- CCITT G.703
- CCITT G.704
- ETSI 300011
- CCITT I.431

First Edition March 1994 Release 3.4.2 and after

2 Mbps ETSI

2 Mbps - ETSI PAL References

ETSI.1. Introduction

This document explains the protocol-specific PAL keywords included in Version 1.0 of the 2 Mbps - ETSI Layer Protocol Package (LPP). Any changes affecting this programming information will be addressed in Release Notes. Directions for installing the LPP on your hard disk and instructions for loading the protocol on the protocol stack can be found in the preface to this binder.

ETSI.2. Condition Keywords

This section provides references for the 2 Mbps - ETSI condition keywords. The keywords are presented alphabetically with a syntactical model, description, type, and an example for each. Additional remarks are included with some keywords to explain special conditions or exceptions.

Each condition keyword is one of two types: external or internal. An external condition results from an event occurring outside the program such as a keystroke from a keyboard, a frame from a network, a trigger, or the occurrence of a timeout. An internal condition, on the other hand, results from an event occurring within the program such as a counter reaching a certain value. With a few exceptions, most interface-specific conditions are external since they result from the reception of a frame.

Examples are shown to demonstrate the use of the keyword. Conditions are analogous to the IF part of an IF-THEN statement. The PAL statement COND x means "if x becomes true." Variable names and values shown in the examples are arbitrary. They suggest programming possibilities. They do not constitute a total program and are not drawn from a real application.

The condition keywords available with the HS_2MBPS LPP are:

- RCVD
- BAD.FCS
- ABORT

The discussion of each keyword includes a syntactical model, a description and an example of its use.

RCVD

Syntax: RX1 RCVD
RX2 RCVD

Description: This condition is true when a valid 2 Mbps frame is received. It can be used for either the RX1 or RX2 receive ports.

Type: External

Example:
```
COND RX1 RCVD
ACTN PROMPT "Receivded a frame from RX1"
```

Remarks: None

BAD.FCS

Syntax: RX1 BAD.FCS
RX2 BAD.FCS

Description: This condition is true when a data frame (not a 2 Mbps frame) with a bad frame check sequence (FCS) is received. It can be used for either the RX1 or RX2 receive ports.

Type: External

Example:
```
COND RX2 BAD.FCS
ACTN PROMPT "Received a BAD.FCS from RX2"
```

Remarks: None

ABORT

Syntax: RX1 ABORT
RX2 ABORT

Description: This condition is true when an Abort is received. It can be used for either the RX1 or the RX2 receive port.

Type: External

Example:
```
COND RX1 ABORT
ACTN PROMPT "Received ABORT from RX1"
```

Remarks: None

ETSI.3. Action Keywords

This section provides references for the 2 Mbps - ETSI action keywords. The keywords are presented alphabetically with a syntactical model, description, type, and an example for each. Additional remarks are included with some keywords to explain special conditions or exceptions.

Examples are shown to demonstrate the use of the keyword. Actions are analogous to the THEN part of an IF-THEN statement. The PAL statement ACTN x means "then execute x." Variable names and values shown in the examples are arbitrary. They suggest programming possibilities. They do not constitute a total program and are not drawn from a real application.

The action keywords available with the HS_2MBPS LPP are:

- FLOOD.NETWORK
- STOP.FLOOD.NETWORK

The discussion of each keyword includes a syntactical model, a description and an example of its use.

FLOOD.NETWORK

Syntax: FLOOD.NETWORK

Description: This action saturates the network with a user-defined text string. In addition, the time interval between the frames may be specified (with 1 microsecond resolution) to control the saturation level of the network.

Example:

```
COND KEY "Aa"
ACTN FLOOD.NETWORK
"flood string"TIME.GAP      [microseconds]
```

Remarks: None

STOP.FLOOD.NETWORK

Syntax: STOP.FLOOD.NETWORK

Description: This action stops the network flooding initiated by the FLOOD.NETWORK action. Flooding stops after the current frame has been completely transmitted.

Example:

```
COND KEY "Ss"
ACTN STOP.FLOOD.NETWORK
```

Remarks: None

PREFACE

This document provides information about the Release 3.4.0 applications for the following WAN interfaces: X.21, V.24, V.35 and V.36. These applications enable you to perform the following tasks:

- gather HDLC line error and performance statistics
- gather SDLC line error and performance statistics
- monitor asynchronous protocols (V.24 only)
- monitor Bisynchronous Communications (BSC) protocol
- monitor SNA
- monitor Bit-Oriented Protocols
- monitor X.25
- monitor X.75
- monitor, calculate, and display SNA gateway transit delay

Except as noted, an application that performs one of these tasks is available for each line interface. Most of the applications run on either Standard or High-Speed WAN interfaces. This document organizes the information about the line interface applications according to task. Each section of the document includes the following information:

- what the application does
- which LPPs are required to run the application
- how to view results and exit the application

The first two sections of the document provide summary information on how to connect the DA-3x to run the applications for each line interface and how to load and run the applications. For additional information about loading and running applications, please refer to Chapter 4, "Applications," in the *DA-30/31 Operating Manual.* If you need more detailed information about line interface operation, see Chapter 7, "Line Interface Operation," in the *DA-30/31 Operating Manual.*

On-line application notes that describe the application and explain when and why to use it are also provided for each application.

Also included with this document is the documentation for the Bit Error Ratio Test (BERT) applications, which run on all four High Speed WAN interfaces.

This document assumes a basic knowledge of the DA-3x. Refer to the *DA-30/31 Operating Manual* for detailed DA-3x operating instructions.

Note:

Each W&G application solves a specific type of network problem. Because each network's troubleshooting needs are unique, the DA-3x provides you with the capability to customize applications (or develop your own) to suit your particular needs. If you change the setup of a W&G application, for example, by altering the loaded protocols or data logging, you must make corresponding changes to the application's Network Event Program. If you do not make these changes, the application may produce unpredictable results. Adding protocols may adversely affect application performance.

W&G provides custom applications. If you have specific application requirements, contact your sales representative to discuss a solution.

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Cabling the DA-3x

This section provides information on how to cable the DA-3x to run the line interface applications. Procedures vary according to which line interface you are using and whether you are connecting the DA-3x in series with the line, in parallel with the line, or in parallel with the line through a patch field.

X.21, V.24

To monitor an X.21 or V.24 line with the DA-3x **in series with the line**, unplug the Data Terminal Equipment (DTE) end of the communications cable from the DTE. Ensure that the opposite end of the communications cable is plugged into the Data Circuit-terminating Equipment (DCE). The gender of the unplugged connector end is typically male. Plug the male connector end into the female DCE connector on the line interface card. Using the four-connector ribbon cable provided by W&G, select one of the male connector ends and plug it into the DTE. Plug the female connector on the opposite end of the ribbon cable into the male DTE connector on the line interface card.

To monitor an X.21 or V.24 line with the DA-3x **in parallel (or bridged) with the line**, unplug the DTE end of the communications cable from the DTE. The gender of this unplugged connector end is typically male. Using the four-connector ribbon cable provided by W&G, select one of the male connector ends and plug it into the DTE. Plug the male connector end of the communications cable into the female connector on the same end of the ribbon cable that is plugged into the DTE. Plug the male connector on the opposite end of the ribbon cable into the female DCE connector on the line interface card.

X.21, V.24, V.35

To monitor an X.21, V.24, or V.35 line with the DA-3x in parallel (or bridged) with the line **through a patch field**, connect the DA-3x to the patch field's monitor connector. Use either the four-connector ribbon cable provided by W&G or your own cable with the appropriate gender connectors for each end. You can use either port on the line interface card to connect to the monitor port of the patch field.

V.35 only

To monitor the V.35 line with the DA-3x **in series with the line**, unplug the DTE end of the V.35 communications cable from the DTE. The opposite end of the V.35 communications cable must be plugged into the DCE. The gender of the unplugged connector end is typically male. Using the four-connector V.35 ribbon cable provided by W&G, plug one of the female connector ends into the male DTE connector on the V.35 Interface Card. Plug the male connector on the opposite end of the ribbon cable into the female end of the V.35 adapter cable provided by W&G. Plug the male V.35 end of the adapter cable into the female V.35 DTE connector. Plug the male connector end of another V.35 cable (not provided by W&G) into the female DCE connector on the V.35 Interface Card. Connect the female connector on the opposite end of other V.35 cable (not provided by W&G) into the male end of the V.35 adapter cable provided by W&G. Plug the female V.35 end of the adapter cable into the male end of the V.35 communications cable that was unplugged from the V.35 DTE.

To monitor the V.35 line with the DA-3x **in parallel (or bridged) with the line**, unplug the DTE end of the V.35 communications cable from the DTE. The gender of this unplugged connector end is typically male. Using the four-connector V.35 ribbon cable provided by W&G, select one of the male connector ends and plug it into the female DCE connector on the V.35 Interface Card. On the opposite end of the ribbon cable, plug the male connector into the female end of the V.35 adapter cable (provided by W&G). Plug the male V.35 end of the adapter cable into the V.35 DTE. Plug the male end of the V.35 adapter cable (provided by W&G) into the female end of the ribbon cable. Plug the female V.35 end of the adapter cable into the V.35 communications cable that was unplugged from the V.35 DTE.

V.36 only

Monitoring Setup

To monitor the RS-449/V.36 line with the DA-3x **in parallel (or bridged) with the line** unplug the DTE end of the RS-449/V.36 communications cable from the DTE. The gender of this unplugged connector end is typically male. Using the four-connector RS-449/V.36 ribbon cable provided by W&G, select one of the male connector ends and plug it into the DTE. Plug the male connector end of the RS-449/V.36 communications cable into the female connector on the same end of the ribbon cable that is plugged into the DTE. Plug the male connector on the opposite end of the ribbon cable into the female connector on the RS-449/V.36 Interface Card.

To monitor the RS-449/V.36 line with the DA-3x in parallel (or bridged) with the line **through a patch field**, connect the DA-3x to the patch field's monitor connector. Use either the W&G provided four-connector ribbon cable or another cable with the appropriate gender connectors for each end. The gender of the connector on the RS-449/V.36 card is male.

Emulation Setup

Emulate DTE: Unplug the existing RS-449/V.36 communications cable from the Data Communications Equipment (DCE). Using the four-connector ribbon cable provided by W&G, plug one of the male connectors into the female connector on the RS-449/V.36 Interface Card. The gender of the RS-449/V.36 connector on the DCE is typically female. Plug the male connector on the opposite end of the ribbon cable into the DCE connector.

Emulate DCE: Unplug the existing RS-449/V.36 communications cable from the Data Terminal Equipment (DTE). Using the four-connector ribbon cable provided by W&G, plug one of the male connectors into the female connector on the RS-449/V.36 Interface Card. The gender of the RS-449/V.36 connector on the DTE is typically female. Plug the male connector on the opposite end of the ribbon cable into the DTE connector.

Token Ring Cabling and Setup (SNA Transit Delay Applications Only)

The SNA Transit Delay (SNATDLYx) applications require both a WAN Interface Card and WAN Feature Module (either Standard or High-Speed) and a Token Ring Interface Card. WAN line interface cabling is described in the preceding sections. This section describes the cabling and setup for the Token Ring interface.

For both 4 Mbps and 16 Mbps Token Ring networks, plug an available MAU port into the AU connector of the DA-3x Token Ring Interface Card currently being used.

To set the Token Ring Rate to match the speed of your network, do the following:

1. On the DA-3x Main Menu, select the Slot Window that corresponds to the Token Ring Interface Card you are using.
2. Press F2 (line setup).
3. Press the Down Arrow key to highlight Token Ring Rate (Mbps) and press F1 to view the options.
4. Select either 4 or 16, depending on the speed of your Token Ring, and press Enter.

Loading and Running the WAN and High-Speed WAN Applications

To use one of these applications, you need to load it into the DA-3x's memory and then go to Run mode. All of the applications can be run as either a single analyzer application or a dual analyzer application except SNA Transit Delay (SNATDLYx), which is a dual analyzer application. Instructions for running both single analyzer and dual analyzer applications are in the following sections.

Your choice of single or dual analysis is partly determined by the type of DA-3x you are working with. If you have a DA-31, which has only one Analyzer Module, or a DA-30 with only one Analyzer Module, follow the instructions for running single analyzer applications.

If you have a DA-30 equipped with two Analyzer Modules, two WAN Feature Modules, and two Line Interface Cards, you can choose either single or dual analysis.

Running Single Analyzer Applications

To run a single analyzer application, which defaults to loading on Analyzer 1, follow these steps:

1. From the DA-3x Main Menu, position the cursor on the Current Application field of the MAINFRAME window. Then press F1 (view options) to access the Application Management menu.
2. Use the Up Arrow or Down Arrow key to position the cursor on the appropriate line interface group and press Enter. The list of available applications appears.
3. Use the Up Arrow or Down Arrow key to position the cursor on the application. Press Enter to load and run the application. Refer to the remaining sections of this manual for specific information about the applications.

Running Dual Analyzer Applications

If you have a DA-30 with two Analyzer Modules, two WAN Feature Modules, and two Line Interface Cards installed, you can run dual analyzer applications by following the steps described below. Note that these instructions assume that the application is loaded on Analyzer 1 first.

1. Follow the instructions for loading the single analyzer application above, but press F1 (LOAD AS IS) to load the application without proceeding to Run mode.
2. With the cursor still in the Current Application field, press F1 (view options) to access the Application Management menu. When the Application Management menu appears, the application you have selected is highlighted.

3. Press F2 (load options) to display a list of loading options. Use the Down Arrow to highlight the "Load An1 application on An2" option and press Enter. The application is loaded on Analyzer 2 and you return to the DA-3x Main Menu.
4. Move the cursor to the Analyzer 1 window by pressing Alt-1 and enable Analyzer 1 by pressing F5 (ENABLE ANALYZER). Because both analyzers will have the same line interface slot selected, you need to change Analyzer 2's slot selection.
5. Move the cursor to Analyzer 2 by pressing Alt-2. With the cursor in the Slot field, press F1 (view options) to display a list of the slots. Select either slot 6 or 7, whichever slot has your second Line Interface Card installed.

After completing the procedure described above for loading the application to run as a dual analyzer application, press Alt-Run to proceed to Run mode.

Line Setup

Line setup varies from interface to interface. For the line setup procedures specific to the interface you are using, refer to Chapter 7, "Line Interface Operation," in the *DA30/31 Operating Manual*.

Gathering HDLC Line Error and Performance Statistics (HDLCSTSx)

Application Name	WAN Interface	Loaded LPPs
HDLCSTS1	X.21 or High Speed X.21	X.21 HDLC
HDLCSTS4	V.24 or High Speed V.24	RS-232_V.24 HDLC
HDLCSTS5	V.35 or High Speed X.35	V.35 HDLC
HDLCSTS6	V.36 or High Speed X.36	RS-449_V.36 HDLC

The HDLC Statistics application monitors WANs running HDLC and gathers line error and performance statistics. You can introduce threshold values for the following errors/events: FCS, Aborts, Short Frames, Link Resets, Retries, and RNR frames, REJ frames, and FRMR frames. The application flags the error/event when the count exceeds the threshold value. When an error threshold is exceeded, the application displays the error/event along with the associated address. A toggle enables you to display the help screen associated with the error. Use the help display to find possible causes of the HDLC layer problem.

The application keeps a current list of error/events, sorted by address, as a quick reference of the number and type of Layer 2 error conditions.

Main Menu Selection

The Main menu that is displayed when you run the application includes the following options:

Key	Action
L	Open the HDLC Line Statistics Error/Event Threshold Setup menu.
H	Open the Help menu, which contains a help file listing the possible causes for each error condition.
M	Open the active monitoring window and start monitoring the line.

Table WAN-1 HDLC Statistics Main Menu Selections

Error/Event Threshold Setup Menu

The Error/Event Threshold Setup menu is displayed when you select option L on the Main menu. It includes the following options:

Key	Action
F	Enter the threshold value of FCS errors.
A	Enter the threshold value of Abort errors.
S	Enter the threshold value of Short Frame errors.
L	Enter Link Reset threshold value.
R	Enter Retries (retransmissions) threshold value.
N	Enter Receiver Not Ready (RNR) Frame threshold value.

Table WAN-2 Error/Event Threshold Setup Menu Options (Part I)

Key	Action
E	Enter Reject (REJ) Frame threshold value.
M	Enter Frame Reject (FRMR) Frame threshold value.
O	Toggle the gathering of HDLC layer error/events On and Off. The HDLC Line Statistics window within the active monitoring window continues gathering and counting statistics.
ESC	Exit the Error/Event Threshold Setup menu.
ENTER	Accept an error threshold value.

Table WAN-2 Error/Event Threshold Setup Menu Options (Part II)

Help Menu

You can access the Help menu as an option on the Main menu, or with the Help key on the WAN Monitoring window. The Help menu provides the following selections:

Key	Action
F	Help with FCS Errors.
A	Help with Abort Errors.
S	Help with Short Frame Errors.
L	Help with Link Resets.
R	Help with Retries (re-transmissions).
N	Help with RNR Frames.
E	Help with REJ Frames.
M	Help with FRMR Frames.
ESC	Exit from Help menu.

Table WAN-3 HDLCSTSx Help Menu Options

Note:

Appendix A of this document contains additional information about the Error conditions used in this application. The Help menu selections provide on-line access to this same information.

WAN Monitoring Window

The following actions are available on the WAN Monitoring window:

Key	Action
T	Toggle between the HDLC Error/Event Address window and the HDLC Error/Event Help window.
U	Toggle between the Line Utilization window and the User Utilization window.
H	Open the Help menu window.
CLEAR	Clear the current error values.
ESC	Exit the WAN Monitoring window.

Table WAN-4 HDLCSTSx WAN Monitoring Window

Viewing Results

You can view network information in the Network Status Display window, and protocol data information in the Character Trace or Protocol Trace Display windows. The HDLC statistics are presented on the WAN Monitoring window.

WAN Monitoring Results

The following results are displayed on the WAN Monitoring window:

Display	Results Information
HDLC Error/Event with Address	This display lists the program-assigned number of the error/event (from 1 to 1000), the exceeded error/event threshold, and the HDLC address associated with the error/event. If the list is longer than one page, scroll arrows appear. To scroll the list, use the Up- or Down Arrow, Page Up or Page Down, Home or End keys.
HDLC Error/Event with Help	This display lists the total number of error/events for a row, the exceeded error/event threshold, and the Help menu to consult for possible causes of the error/event.
HDLC Line Statistics	This display shows the total number of Information Frames, Supervisory Frames, Total Polls (Receiver Ready exchanges), and Unnumbered Information Frames. The display also shows the percentage of Line Utilization for each frame type.
User Utilization	This display shows the percentage of utilization for the first six addresses and frame counts by side of line. The # field is the decimal equivalent of the HDLC address. The # DCE and # DTE fields display total frame counts by side of line. The % Util field shows total utilization for that address.

Table WAN-5 HDLCSTSx Monitoring Results

Exiting the Application

Press Alt-Menu to return to the DA-3x Main Menu. Press Alt-Exam to go to Examine Mode.

Gathering SDLC Line Error and Performance Statistics (SDLCSTSx)

Application Name	WAN Interface	Loaded LPPs
SDLCSTS1	X.21 or High Speed X.21	X.21 SDLC
SDLCSTS4	V.24 or High Speed V.24	RS-232_V.24 SDLC
SDLCSTS5	V.35 or High Speed V.35	V.35 SDLC
SDLCSTS6	V.36 or High Speed V.36	RS-449_V.36 SDLC

This application monitors a network running SDLC and gathers line error and performance statistics. You can introduce threshold values for the following errors/events: FCS, Aborts, Short Frames, Link Resets, Retries, and RNR frames, REJ frames, and FRMR frames. The application flags the error/event when the count exceeds the Threshold value. When an error threshold is exceeded, the application displays the error/event along with the associated address. A toggle lets you display the help screen associated with the error. Use the help display to find possible causes of the SDLC layer problem.

The application keeps a current list of error/events by address as a quick reference of the number and type of Layer 2 error conditions.

Main Menu Selection

The Main menu that is displayed when you run the application includes the following options:

Key	Action
L	Open the SDLC Line Statistics Error/Event Threshold Setup Menu.
H	Open the Help menu, which contains a help file listing the possible causes for each error condition.
M	Open the active monitoring window and start monitoring the line.

Table WAN-6 SDLC Statistics Main Menu Selections

Error/Event Threshold Setup Menu

The Error/Event Threshold Setup menu is displayed when you select option L on the Main menu. It includes the following options:

Key	Action
F	Enter the threshold value of FCS Errors.
A	Enter the threshold value of Abort errors.
S	Enter the threshold value of Short Frame errors.
L	Enter Link Reset threshold value.
R	Enter Retries (retransmissions) threshold value.
N	Enter Receiver Not Ready (RNR) Frame threshold value.

Table WAN-7 Error/Event Threshold Setup Menu Options (Part I)

Key	Action
E	Enter Reject (REJ) Frame threshold value.
M	Enter Frame Reject (FRMR) Frame threshold value.
O	Toggle the gathering of SDLC layer error/events On and Off. The SDLC Line Statistics window within the active monitoring window continues gathering and counting statistics.
ESC	Exit the Error/Event Threshold Setup menu.
ENTER	Accept an error threshold value.

Table WAN-7 Error/Event Threshold Setup Menu Options (Part II)

Help Menu

You can access the Help menu as an option on the Main menu, or with the Help key on the WAN Monitoring window. The Help menu provides the following information selections:

Key	Action
A	Help with Abort errors.
S	Help with Short Frame errors.
L	Help with Link Resets.
R	Help with Retries (re-transmissions).
N	Help with RNR frames.
E	Help with REJ frames.
M	Help with FRMR frames.
ESC	Exit the Help menu.

Table WAN-7 SDLCSTSx Help Menu Options

Note:

Appendix A of this document contains additional information about the Error conditions used in this application. The Help menu selections provide on-line access to this same information.

WAN Monitoring Window

The following actions are available on the WAN Monitoring window:

Key	Action
T	Toggle between the SDLC Error/Event Address window and the SDLC Error/Event Help window.
U	Toggle between the Line Utilization window and the User Utilization window.
H	Open the Help menu window.
CLEAR	Clear the current error values.
ESC	Exit the WAN Monitoring window.

Table WAN-8 SDLCSTSx WAN Monitoring window

Viewing Results

You can view network information in the Network Status Display window, and protocol data information in the Character Trace or Protocol Trace Display windows. The SDLC statistics are presented on the WAN Monitoring window.

Main Monitoring Screen Results

The following results are displayed on the WAN Monitoring window:

Display	Results Information
SDLC Error/Event with Address	This display lists the program-assigned number of the error/event (from 1 to 1000), the exceeded error/event threshold, and the SDLC address associated with the error/event. If the list is longer than one page, scroll arrows appear. To scroll the list, use the Up- or Down Arrow, Page Up or Page Down, Home or End keys.
SDLC Error/Event with Help	This display lists the total number of error/events with Help for a row, the exceeded error/event threshold, and the Help menu to consult for possible causes of the error/event.
SDLC Line Statistics	This display shows the total number of Information Frames, Supervisory Frames, Total Polls (Receiver Ready exchanges), and Unnumbered Information Frames. The display also shows the percentage of Line Utilization for each frame type.
User Utilization	This display shows the percentage of utilization for the first six addresses and frame counts by side of line. The # field is the decimal equivalent of the SDLC address. The # DCE and # DTE fields display total frame counts by side of line. The % Util field shows total utilization for that address.

Table WAN-9 SDLCSTSx Monitoring Results

Exiting the Application

Press Alt-Menu to return to the DA-3x Main Menu. Press Alt-Exam to go to Examine Mode.

Monitoring Asynchronous Protocols (MONASC24)

Application Name	WAN Interface	Loaded LPPs
MONASC24	V.24	RS232/V.24

This application monitors asynchronous protocols running on an RS-232C/V.24 interface. It provides Network Status information about the network running the protocol. This information includes Receiver activity, Transmitter activity, Control Lead activity, and Errors. A Character Trace display shows the character data sent and received on the network.

Note that since the High Speed WAN interfaces do not support character-oriented protocols (i.e., Asynchronous or Bisynchronous data framing), this application runs only on the Standard V.24 interface.

Viewing Results

View network information in the Network Status Display window or protocol data information in the Character Trace or Protocol Trace Display windows.

Exiting the Application

Press Alt-Menu to return to the DA-3x Main Menu. Press Alt-Exam to go to Examine Mode.

Monitoring Bisynchronous Communication Protocol (MONBSCx)

Application Name	WAN Interface	Loaded LPPs
MONBSC1	X.21	None
MONBSC4	V.24	None
MONBSC5	V.35	None
MONBSC6	V.36	None

This application monitors Bisynchronous Communications (BSC) protocol running on the specified interface. It also provides Network Status information about the network running the protocol, and a Character Trace Display of the frame data sent and received on the network.

Note that since the High Speed WAN interfaces do not support character-oriented protocols (i.e., asynchronous or bisynchronous data framing), this application runs only on the Standard WAN interfaces.

Viewing Results

View network information in the Network Status Display window or protocol data information in the Character Trace or Protocol Trace Display windows.

Exiting the Application

Press Alt-Menu to return to the DA-3x Main Menu. Press Alt-Exam to go to Examine Mode.

Monitoring SNA (MONSNAx)

Application Name	WAN Interface	Loaded LPPs
MONSNA21	X.21 or High Speed X.21	SDLC SNA
MONSNA24	V.24 or High Speed V.24	SDLC SNA
MONSNA35	V.35 or High Speed V.35	SDLC SNA
MONSNA36	V.36 or High Speed V.36	SDLC SNA

This application monitors the SDLC and SNA protocols running on the specified interface. It provides Network Status information about the network running the protocol. It also provides Character Trace, and SDLC and SNA Protocol Trace Displays of the frame data sent and received on the network.

Viewing Results

View network information in the Network Status Display window or protocol data information in the Character Trace or Protocol Trace Display windows.

Exiting the Application

Press Alt-Menu to return to the DA-3x Main Menu. Press Alt-Exam to go to Examine Mode.

Monitoring Bit-Oriented Protocols (MONx)

Application Name	WAN Interface	Loaded LPPs
MONX21	X.21	None
MONV24	V.24	None
MONV35	V.35	None
MONV36	V.36	None
MONHSX21	High-Speed X.21	None
MONHSV24	High-Speed V.24	None
MONHSV35	High-Speed V.35	None
MONHSV36	High-Speed V.36	None

This application monitors Bit-Oriented Protocols running on the specified interface. It provides Network Status information about the network running the protocol. This information includes Receiver activity, Transmitter activity, Control Lead activity, and Errors. A Character Trace display shows the frame data sent and received on the network. This is the default application for all interfaces.

Viewing Results

View network information in the Network Status Display window or protocol data information in the Character Trace or Protocol Trace Display windows.

Exiting the Application

Press Alt-Menu to return to the DA-3x Main Menu. Press Alt-Exam to go to Examine Mode.

Monitoring X.25 (MONX25xx)

Application Name	WAN Interface	Loaded LPPs
MONX2521	X.21 or High Speed X.21	HDLC X.25
MONX2524	V.24 or High Speed V.24	HDLC X.25
MONX2535	V.35 or High Speed V.35	HDLC X.25
MONX2536	V.36 or High Speed V.36	HDLC X.25

This application monitors the HDLC and X .25 protocols running on the specified interface. It provides Network Status information about the network running the protocol. It also provides Character Trace and HDLC and X.25 Protocol Trace Displays of the frame data sent and received on the network.

Viewing Results

View network information in the Network Status Display window or protocol data information in the Character Trace or Protocol Trace Display windows.

Exiting the Application

Press Alt-Menu to return to the DA-3x Main Menu. Press Alt-Exam to go to Examine Mode.

Monitoring X.75 (MONX75xx)

Application Name	WAN Interface	Loaded LPPs
MONX7521	X.21 or High Speed X.21	HDLC X.75
MONX7524	V.24 or High Speed V.24	HDLC X.75
MONX7535	V.35 or High Speed V.35	HDLC X.75
MONX7536	V.36 or High Speed V.36	HDLC X.75

This application monitors the HDLC and X.75 protocols running on the specified interface. It provides Network Status information about the network running the protocol. It also provides Character Trace and HDLC and X.75 Protocol Trace Displays of the frame data sent and received on the network.

Viewing Results

View network information in the Network Status Display window or protocol data information in the Character Trace or Protocol Trace Display windows.

Exiting the Application

Press Alt-Menu to return to the DA-3x Main Menu. Press Alt-Exam to go to Examine Mode.

SNA Gateway Transit Delay (SNATDLYx)

Application Name	WAN Interface	Loaded LPPs
SNATDLY1	X.21 or High Speed X.21	MAC_802.5 (Analyzer 2) LLC_802.2 (Analyzer 2) SDLC (Analyzer 1) SNA (Analyzer 1 and 2)
SNATDLY4	V.24 or High Speed V.24	MAC_802.5 (Analyzer 2) LLC_802.2 (Analyzer 2) SDLC (Analyzer 1) SNA (Analyzer 1 and 2)
SNATDLY5	V.35 or High Speed V.35	MAC_802.5 (Analyzer 2) LLC_802.2 (Analyzer 2) SDLC (Analyzer 1) SNA (Analyzer 1 and 2)
SNATDLY6	V.36 or High Speed V.36	MAC_802.5 (Analyzer 2) LLC_802.2 (Analyzer 2) SDLC (Analyzer 1) SNA (Analyzer 1 and 2)

This application monitors, calculates, and displays the transit delay of frames through an SNA gateway to a specific set of addresses on a Token Ring and an X.21, V.24, V.35, or V.36 SNA network.

Use this application to determine whether or not a response time problem exists with the SNA gateway. For example, you can monitor traffic going into an SNA gateway as Token Ring SNA frames (shown in the Analyzer 2 Display window) and coming out as SDLC/SNA frames (shown in the Analyzer 1 Display window).

Cabling and line setup information for this application are provided on page WAN-5 of this document.

Note:

This application requires a DA-30 configuration consisting of two Analyzer Modules, one Token Ring Interface, one WAN Feature Module or High-Speed WAN Feature Module, and an X.21, V.24, V.35, or V.36 Interface Module. This application does not run on a DA-31.

Test Setup Selection

The Test Setup screen is split into two windows that provide menus of test setup selections for Analyzer 1 and Analyzer 2. Use the Tab key to move the cursor from one window to the other. Tables WAN-11 and WAN-12 list the test setup options for each analyzer.

Analyzer 1 (WAN Side)

Key	Action
L	Logical Unit (LU) address of the X.21 SNA frame.
P	Physical Unit (PU) address of the X.21 SNA frame.
[DW-L3]	Select the Layer 3 Display window to return to the Analyzer 1 Setup menu from another display format (e.g., Network Statistics)

Table WAN-11 Analyzer1 Test Results Options

Analyzer 2 (Token Ring Side)

Key	Action
L	Logical Unit (LU) address of Token Ring SNA frame.
A	Alarm threshold time in milliseconds. An audible alarm sounds if the transit through the gateway is longer than the selected value.
S	Start the test.
R	Open the Test Results window.
[DW-L3]	TEST RESULTS–Select the Layer 3 Display window to return to the Test Results window from another display format (e.g., Network Statistics)

Table WAN-12 Analyzer 2 Test Results Options

Viewing Results

View network information in the Network Status Display window or protocol data information in the Character Trace or Protocol Trace Display windows.

The Analyzer 2 (Token Ring Side) Test Results window shows the delays for both WAN-to-LAN and LAN-to-WAN transit through the gateway. The test result values are as follows:

PRE:	Previous response time in microseconds.
AVE:	Average response time in microseconds.
MIN:	Minimum response time in microseconds.
MAX:	Maximum response time in microseconds.
# OF ALARMS:	Number of times the transit delay exceeds the alarm threshold.

Test Results Window Selections

You can also select the following option from the Test Results menu:

Key	Action
S	Stop the test.
C	Clear the test results.
M	Return to the Setup menu

Table WAN-12 Test Results Menu

Exiting the Application

Press Alt-Menu to return to the DA-3x Main Menu. Press Alt-Exam to go to Examine Mode.

Appendix A

This appendix describes the error conditions used in the HDLC and SDLC Statistics Applications (MONX251 and SDLCSTS1). This information is also available on-line through the Statistics Applications Help Menus.

FCS ERRORS

A Frame Check Sequence (FCS) error occurs when a frame is received with an FCS calculation that is different from the frame content and the FCS polynomial algorithm.

FCS errors are caused by bad terminal devices (FEP, controller, PAD), bad modems, cable lengths close to or exceeding interface standards, loose or bad connectors, or TelCo line-related problems.

Frames with bad Frame Check Sequences are discarded upon receipt. The transmitting device must determine that the receiver rejected the frame.

ABORTS

An Abort error occurs when a terminal device (FEP, controller, PAD) terminates the transmission of a frame. The abort pattern consists of at least 8 consecutive 1 bits. The frame aborts without an FCS field or ending flag.

Both primary and secondary stations can abort frames. A station aborts on a Data Underrun error during character transfer between the secondary station's communication controller and the terminal system's central processing unit.

SHORT FRAME

A Short frame error occurs when a frame's length is less than the required number of bytes. For most frames this length is 6 bytes, including the opening and closing flags.

Short frames are caused by cable lengths close to or exceeding interface standards, loose or bad connectors, or by TelCo related line problems such as line hits.

In accordance with protocol rules, the receiving device ignores Short frames.

LINK RESETS

A Link Reset condition occurs when the Level 2 link is reset using the proper Level 2 re-initialization procedure.

Link Resets occur because of an FRMR condition, which initiates link re-initialization, or because of a disconnect command sent to a secondary station followed by a link setup command.

High Link Reset rates and high FRMR rates indicate bad terminal devices, cable lengths close to or exceeding interface standards, loose or bad connectors, or TelCo line related problems.

RETRIES

A Retry is an unrequested transmission resulting from a time-out condition. The two basic time-out conditions are Idle Detect and Non-Productive Receive. Retry counters and recovery action are the responsibility of primary stations.

Excessive Retries occur because of an expired idle detect timer, or an unintelligible received signal (non-productive receive). Other causes are bad terminal devices (FEP, controller, PAD), cable lengths close to or exceeding protocol standards, loose or bad connectors, or TelCo related line problems.

RNR FRAMES

A Receiver Not Ready (RNR) frame can occur in a primary or a secondary station. It indicates a temporary busy condition due to limited buffer space or other internal constraints. An RNR can acknowledge receipt of sequenced frames.

High RNR rates may indicate a problem with the buffer space of a device or an internal problem with the device. Other possible causes are cable lengths close to or exceeding interface standards, loose or bad connectors, or a TelCo related line problem.

REJ FRAMES

A Reject (REJ) frame can be transmitted to request transmission or re-transmission of numbered information frames. A REJ confirms the receipt of frames N(r)-1 and requests the retransmission of frames starting at the N(r) contained in the REJ frame.

Excessive REJ frames may be caused by bad sequencing in a device (FEP, controller, PAD), cable lengths close to or exceeding the interface standards, loose or bad connectors, or TelCo related line problems.

FRMR FRAMES

A Frame Reject (FRMR) frame is transmitted by a secondary station when it receives an invalid frame. The station repeats FRMR to all incoming frames until it receives the proper link re-initialization procedure to reset the Level 2 link.

FRMR conditions occur when an invalid N(s) is received, a prohibited I-field is received (the control field of the received frame does not allow an I-field), or an invalid or non-implemented command is received. A FRMR condition may also be caused by a buffer overrun (I-field is too long—this use is optional).

Bit Error Ratio Test Application for Wide Area Networks

(BERT)

PREFACE

Purpose and Scope

This document describes how to load and operate the Bit Error Ratio Test (BERT) Application which runs on the Wandel & Goltermann DA-3x Protocol Analyzer. The BERT Application allows you to perform loopback and bit error testing on transmission lines, Wide Area Network (WAN) interconnect devices (e.g. DTE, DCE, etc.). You should have a working knowledge of WANs, DTE and DCE devices, and BERT error statistics to use this application. This document assumes a basic knowledge of the DA-3x. Refer to the *DA-30/31 Operating Manual* for detailed operating instructions.

Requirements

The BERT Application runs on the DA-3x under Release 3.4. If you are currently running Core Software Version 3.3 or an earlier release on your DA-3x, you need to upgrade to Release 3.4.

There are five versions of the BERT Application—one for each of the supported line interfaces. These applications and their corresponding line interfaces are:

Application	Line Interface
BERT_X21	X.21 Line Interface
BERT_V24	V.24 Line Interface
BERT_V35	V.35 Line Interface
BERT_V36	V.36 Line Interface
BERT_T1	T1 Line Interface

Load and run the application that is appropriate for the WAN line interface under test.

Note:

Although this document describes the operation for all of the above-mentioned BERT applications, many of the screens, windows and menus that are used as examples correspond to those displayed by the BERT Application for the X.21 interface (BERT_X21). Any interface-specific differences in these screens, windows and menus are noted in the appropriate sections.

Before running the BERT Application, you need to have a High Speed WAN Feature Module and WAN Line Interface Module combination installed in slots 4 and 5 or slots 6 and 7 of your DA-3x. Also, the latest version of the High Speed WAN Line Interface Package—that corresponds with your interface—must be installed on your DA-3x's hard disk.

How This Manual Is Organized

This document is organized into the following chapters:

Chapter 1, Getting Started	introduces the BERT Application, describes what the application does and when it should be used. This chapter also provides instructions for connecting the DA-3x to the device under test and for loading and running BERT.
Chapter 2, BERT Basics	describes the components of the BERT Main menu, describes on-line help and the softkey rack, indicates where to find procedures for loading the application and using it to perform BERTs, and details the difference between the BERT Application's two operational modes.
Chapter 3, BERT Test Setup	describes how to set up the BERT line interface and transmitter options.
Chapter 4, Performing the BERT	provides information on performing the loopback (local and remote) and BERT. It also provides information on interpreting BERT statistics.

Revision History

The following is the revision history for the Bit Error Ratio Test (BERT) Application document.

First Edition	October 1993
Second Edition	November 1993

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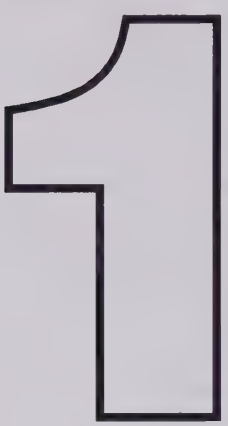


Getting Started

This chapter introduces the Bit Error Ratio Test (BERT) Application and describes what the application does and when it should be used. It also provides instructions for connecting the DA-3x to the device under test (DTE or DCE) and for loading and running the BERT Application.

1.1. What Does the BERT Application Do?

The BERT Application enables the DA-3x to test the reliability of a digital transmission channel between a DTE and local or remote DCE. It also enables the DA-3x to check the functioning of local and remote DCEs.

BERT testing involves a transmitter and receiver that independently generate the same bit (test) pattern. The BERT Application enables the DA-3x to act as a BERT tester. Generally, a BERT tester generates a test pattern which is transmitted by its BERT transmitter to the device under test. The pattern is then looped back to its own BERT receiver on the channel that is under test. This allows for duplex (transmit and receive) line testing with only one BERT tester. The pattern can also be sent from the transmitter of one BERT tester, passed through the device under test, and received by a second BERT tester. This allows for simplex (transmit or receive) line testing.

When the DA-3x receives a test pattern, it compares the received pattern to the specified test pattern (generated in the receiver) to determine whether errors occurred.

1.2. Off-Line Only!

The BERT Application is an off-line test tool. In the BERT mode, only BERT statistics are valid. All other network/interface statistics that can be accessed via the softkey rack (e.g. Network Summary, Character Trace, etc.) are unreliable.

1.3. When Should You Use the BERT Application?

The error statistics and performance parameters provided by BERT can be used:

- to check the proper operation of a DCE (local or remote)
- as an acceptance criteria to test interconnection devices (e.g. repeaters) before installation on a live network
- to check the reliability of the transmission channels between a DTE and DCE as a restart test whenever an interconnection device is upgraded or expanded

Note:

A transmission channel consists of interface cables as well as any interconnecting devices inserted on the line.

1.4. What Hardware and Software Is Needed?

The BERT Application is a single analyzer application. To run the BERT Application, you must have a High Speed WAN Feature Module and a WAN Line Interface Module installed in the interface slots of your DA-3x. The High Speed WAN Feature Module and WAN Line Interface Module (V.24, V.35, V.36, X.21 or T1) must be installed in adjacent interface slots (slots 4 and 5 or slots 6 and 7). Moreover, you must have a Protocol Analyzer Module installed in slot 2 or 3.

Caution:

Do not attempt to run the BERT Application as a dual analyzer application. You risk the corruption of the BERT test pattern files.

The DA-3x Main Menu, as shown in Figure 1-1, reflects the instrument's architecture.

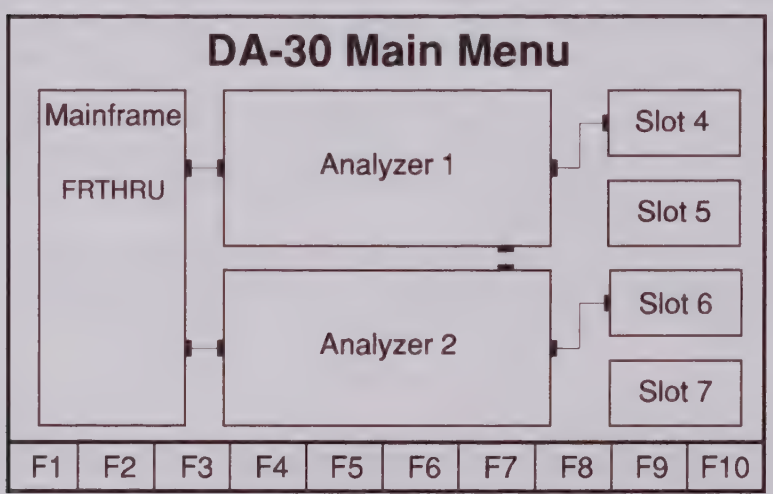


Figure 1-1 DA-3x Main Menu (reflecting the instrument's architecture)

Slot 2 or 3 contains the analyzer module. If the analyzer module is in slot 2 (Analyzer 1) then the High Speed WAN Feature Module and the WAN Line Interface should occupy slots 4 and 5. If the analyzer module is in slot 2 (Analyzer 2) then the High Speed WAN Feature Module and the WAN Line Interface should occupy slot 6 and 7.

You must also have the following software loaded on your DA-3x's hard disk.

- Release 3.4 (or later) Core Software
- High Speed WAN Line Interface Package

1.5. Connecting to the Device Under Test

A generic diagram of a Wide Area Network (WAN) is shown in Figure 1-2. The DA-3x can be configured to emulate the local DTE, the local DCE, the remote DTE or remote DCE in this diagram.

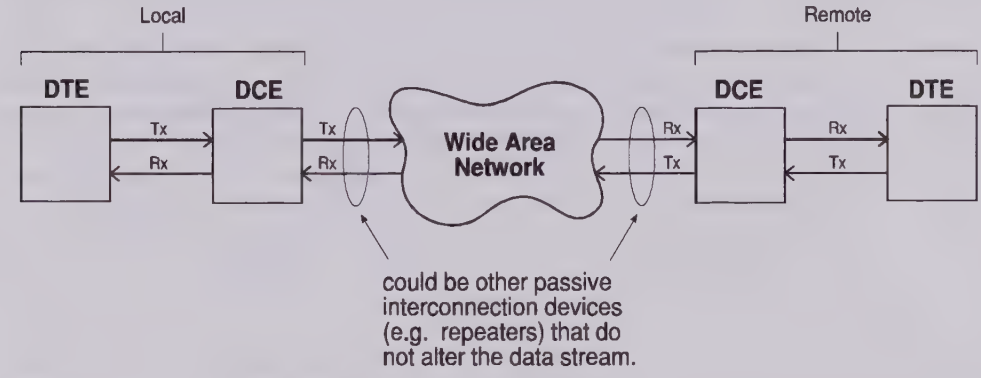


Figure 1-2 Generic WAN Diagram

The testing configurations basically fall into two categories: Loopback configurations and Thru (Non-loopback) configurations.

The Loopback configurations allow a single DA-3x to be used for BERT testing on both transmit and receive lines simultaneously. The BERT Application provides software initialization for local and remote loopback on the X.21 and V.24 Line Interfaces only. Loopback can be achieved on the other interfaces by using an additional loopback cable. In any case, before performing loopback, the DA-3x must be setup for DTE emulation.

Figure 1-3 shows a local loopback configuration that allows the DA-3x to test the functioning of the local DCE as well as the reliability of both the transmit and receive lines (duplex) at the local DTE-DCE interface.

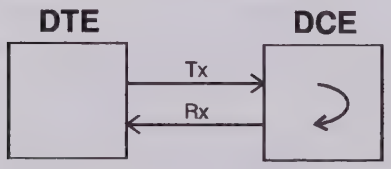


Figure 1-3 Local Loopback Configuration

Figure 1-4 shows a remote loopback configuration that allows the DA-3x to test the functioning of the remote DCE, the reliability of the transmit and receive lines at the local DTE-DCE interface as well as the WAN transmission path from the local DCE to the remote DCE and back.

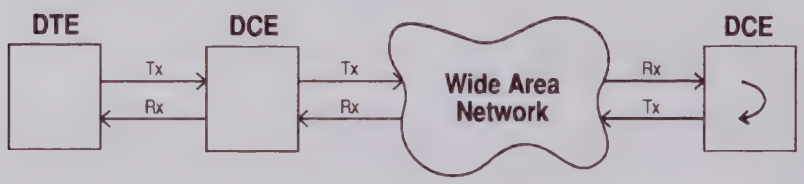


Figure 1-4 Remote Loopback Configuration

To perform loopback using an X.21 interface, you simply connect a DB15 cable between the DA-3x's DTE connector and the appropriate connector of the local DCE as shown in Figures 1-3 and 1-4. To perform loopback using the V.24 interface, however, requires the use of the auxiliary pins (AUX 1 and AUX 2) located on the rear panel of the V.24 Line Interface Module (LIM). This can be accomplished by building a special DB25 cable that breaks out pins 18 and 25 from the end that attaches to the DA-3x's DTE connector (Figure 1-5). Pin 18 should then be connected to AUX 1, and pin 25 should be connected to AUX 2. Connect the other end of the cable to the appropriate connector on the local DCE.

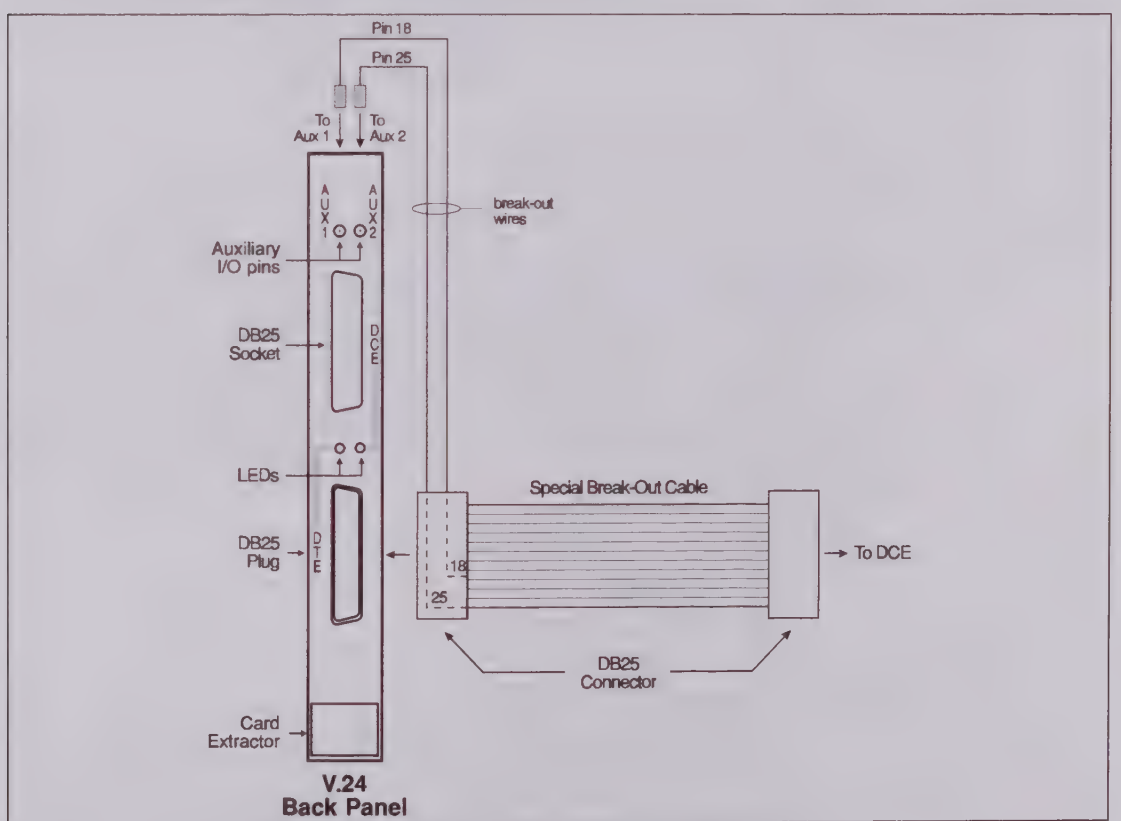


Figure 1-5 Special Break-Out Cable for V.24 Loopback

The Thru configurations limit you to simplex line testing (transmit or receive). Only some DCE functionality is tested. In the following Thru configurations, the DA-3x can be setup to emulate either the DTE or the DCE. Moreover, a second DA-3x (or another BERT tester—one setup for DTE emulation, the other setup for DCE emulation—could be used to test both the transmit and receive paths simultaneously. Of course, both testers must be in the BERT mode.

Note:

The terms "DTE" and "DCE" are used in the following discussion of the Thru configurations. However, if you are testing on a T1 network, the term "DTE" corresponds to a CPE (Customer Premises Equipment), and the term "DCE" corresponds to a CSU (Channel Service Unit) or some other network terminating device. When connecting your T1 interface, use only the CPE ports. They are labeled "TO NET" on the rear panel.

Figure 1-6 shows a configuration that allows the DA-3x to test the reliability of the receive line at the local DTE-DCE interface (if emulating a DTE) or the transmit line at the local DTE-DCE interface (if emulating a DCE).

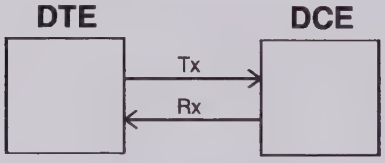


Figure 1-6 Thru Configuration 1

Figure 1-7 shows a configuration that allows the DA-3x to test the reliability of the receive line at the local DTE-DCE interface and the WAN transmission path from the remote DCE to the local DCE (if emulating a local DTE). This configuration also allows the DA-3x to test the reliability of the transmit line at the local DTE-DCE interface and the WAN transmission path from the local DCE to the remote DCE (if emulating a remote DCE).

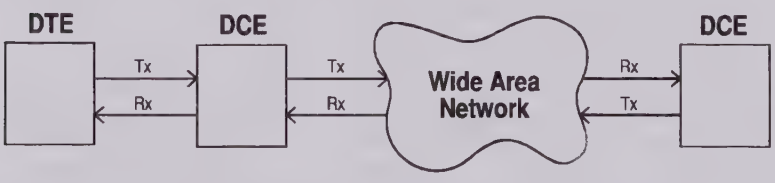


Figure 1-7 Thru Configuration 2

Figure 1-8 shows a configuration that allows the DA-3x to test the reliability of the transmit line at the remote DTE-DCE interface and the WAN transmission path from the remote DCE to the DA-3x (if emulating a local DCE). This configuration also allows the DA-3x to test the reliability of the receive line at the remote DTE-DCE interface and the WAN transmission path from the local DCE to the remote DCE (if emulating a remote DTE).

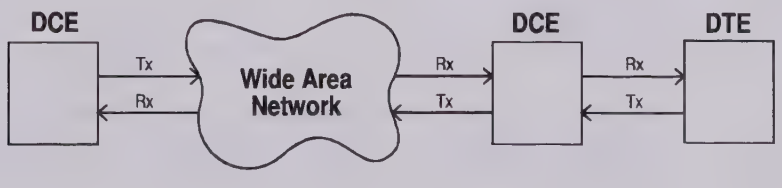


Figure 1-8 Thru Configuration 3

If you are testing on a T1 network, you have an additional connection possibility. The T1 interface can be connected, in series, between a CPE and a CSU. The incoming traffic (Tx or Rx line) is received on the "TO NET" IN connector, routed through the T1 interface, and sent back out on the "TO CPE" OUT connector. Once connected, the T1 interface should be configured in a "pass-through" mode by setting the Test Function field (on the T1 Line Setup menu) to RECEIVE ONLY. The "pass-through" mode does not allow error insertion.

Prior to running BERT, you need to connect the DA-3x to the device under test as shown in Figure 1-9.

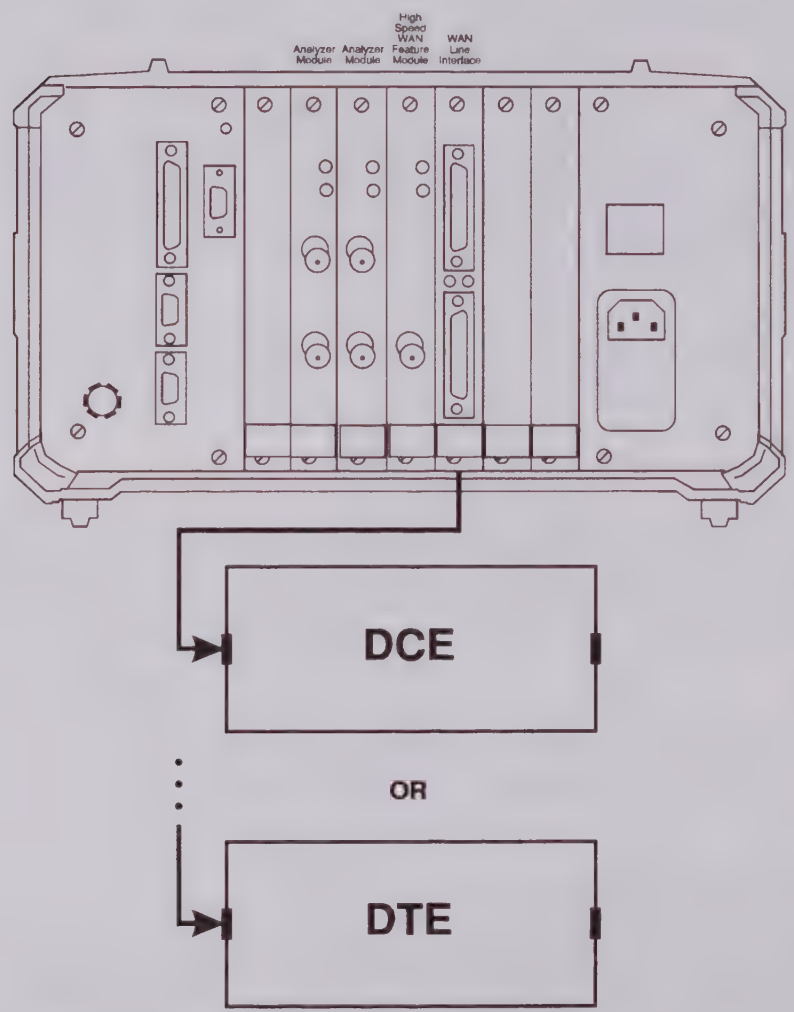


Figure 1-9 Connecting the DA-3x to the Device Under Test

For more detailed information on how to connect your particular interface, refer to the appropriate line interface section of the *DA-30/31 Line Interface Operation* binder.

Note:

All of the above Thru configuration are not typical test setups. However, they can be useful in laboratory settings when testing experimental networks, interconnecting devices, etc.

1.6. Loading and Running the BERT Application

In order to use the BERT Application, you need to load it into the DA-3x's memory and then go to Run mode. To load and run BERT, follow these steps:

1. From the DA-3x Main Menu, position the cursor on the Current Application field of the Mainframe window. Then press F1 (view options) to access the Application Management menu.
2. Using the Up Arrow or Down Arrow, position the cursor on the Application Group that leads to the BERT Application and press Enter. The list of available applications and subgroups appears. Continue searching through the subgroups of the tree structured directory until you reach the group containing the BERT Application.
3. Using the Up Arrow or Down Arrow, position the cursor on the BERT Application. Press Enter to load and run the application or press F1 (LOAD AS IS) to load the application and return to the DA-3x Main Menu.

From the DA-3x Main Menu, if the BERT Application has already been loaded, you can run BERT by simply pressing Alt-Run.

1.7. Modifying the Line Setup

BERT requires the line setup to be compatible with your network for the application to run. Refer to the appropriate line interface section of the *DA-30/31 Line Interfaces Operation* binder for information on modifying the line setup for the interface you are using.

1.8. What Should You Do If You Get Lost?

If you get lost or unable to return to a particular screen when you first start using the BERT Application, the information in Table 1-1 may be helpful.

If you are viewing...	And you want to...	Then...
The BERT Statistics screen or any BERT menu	Return to the BERT Main menu	Press Esc until the BERT Main menu appears
Any BERT screen or menu	Return to the DA-3x Main menu	Press Alt-menu (or Ctrl-M)
The BERT Main menu	Display on-line help information	Select Help from the BERT Main menu
Any DA-3x Run Mode screen	Return to BERT Main menu	Press F12 to display the top level softkey rack. Then press F10 (MORE) and F1 (APPL SCREEN)

Table 1-1 Menu Navigation Summary

1.9. Exiting the Application

You may want to exit BERT occasionally and return to the DA-3x's Main Menu, for example, if you have finished transmitting BERT test patterns and want to run another DA-3x application. You must return to the DA-3x's Main Menu before loading a different application. The Exit-MENU option on the Exit pull-down menu allows you to return to the DA-3x's Main Menu. Simply follow these steps:

1. Select Exit-MENU from the Exit pull-down menu.
2. The DA-3x exits BERT and returns to Menu mode.

However, to quickly return to the DA-3x's Main Menu, you could also press Alt-Menu (or Ctrl-M).

1.10. Where to Go for More Information

Refer to the remaining chapters of this manual for detailed information about the application. If you would like more information about loading and running applications, refer to Chapter 4, "Applications" of the *DA-30/31 Operating Manual*.

For more information on BERT statistics and performance parameters, see *CCITT Recommendation G.821*.

2

BERT Basics

This chapter describes the components of the BERT Main menu and details the difference between BERT's two operational modes.

2.1. The BERT Main Menu

When you run the BERT Application, the BERT Main menu appears, as shown in Figure 2-1.

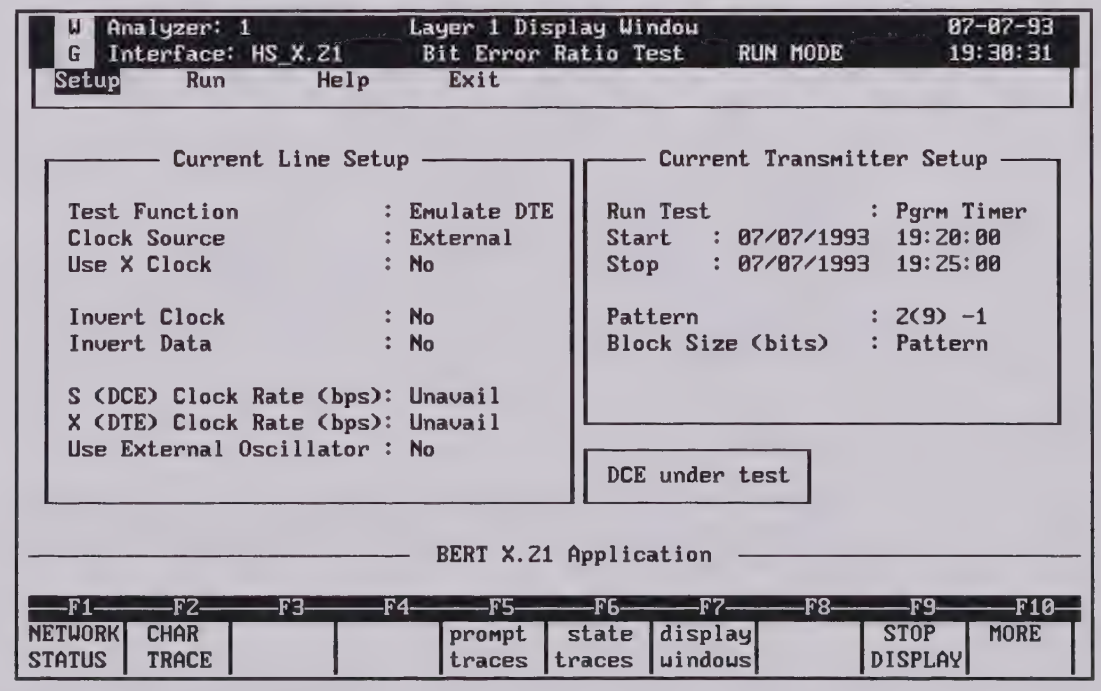

W Analyzer: 1 Layer 1 Display Windou 07-07-93
G Interface: HS_X.21 Bit Error Ratio Test RUN MODE 19:30:31
Setup Run Help Exit
Current Line Setup
Test Function : Emulate DTE
Clock Source : External
Use X Clock : No
Invert Clock : No
Invert Data : No
S (DCE) Clock Rate (bps): Unavail
X (DTE) Clock Rate (bps): Unavail
Use External Oscillator : No
Current Transmitter Setup
Run Test : Pgrm Timer
Start : 07/07/1993 19:20:00
Stop : 07/07/1993 19:25:00
Pattern : 2(9) -1
Block Size (bits) : Pattern
DCE under test
BERT X.21 Application
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
NETWORK STATUS
CHAR TRACE
prompt traces
state traces
display windows
STOP DISPLAY
MORE

Figure 2-1 BERT Main Menu

The components of the BERT Main menu include:

- menu bar
- current line setup window
- current transmitter setup window
- device under test window
- prompt line
- Run mode softkey rack

These components are described in the following sections.

2.1.1. Menu Bar

The menu bar is located at the top of the screen. It contains the keywords for the application's pull-down menus as shown in Table 2-1:

Menu Item	Provides options for...
Setup	configuring the line interface and BERT transmitter. Setting the period for automatic printing of the statistics screen. Enabling the loopback verification and automatic loop delay calculation.
Run	selecting a loopback initialization (local or remote) to be performed on the device under test before BERT execution or for executing BERT directly. Loopback is available for the X.21 and V.24 interfaces only.
Help	displaying helpful information about BERT including keyboard and version number information
Exit	exiting BERT Application and returning to DA-3x's Main Menu

Table 2-1 Menu Bar Items

Use the Right Arrow or Left Arrow key to move among the menu bar items. To display the pull-down menu for a menu item, position the cursor on the keyword (such as Setup) and press Enter. On the pull-down menu, you can use the Up/Down Arrow keys to position the cursor on a desired item and press Enter to select it.

2.1.2. Current Line Setup

The BERT Current Line Setup window appears when you run the application. BERT displays this window whenever you are at the BERT Main menu. This window summarizes the current settings for the line interface.

The setup fields shown are a subset of the line settings available from the Line Setup menu accessed via the interface slot window (DA-3x Main Menu). The settings for these fields, at the time the BERT Application is run, are used as the application's default settings. These settings can, of course, be modified within the BERT Application via the Line option on the Setup pull-down menu. However, when you exit the BERT Application, the original line settings are not altered.

Because the setup fields actually displayed in the Current Line Setup window vary depending on the interface that you have installed, a discussion of these fields has been reserved for Section 3.2.1, "Line Setup." Refer to the sub-section that corresponds to your interface (e.g. Section 3.2.1.1, "X.21 Line Setup" for the X.21 interface).

2.1.2.1. V.24, V.35, V.36 and X.21

The Current Line Setup window for the V.24, V.35, V.36 and X.21 interfaces resembles the one shown in Figure 2-2.

```
Current Line Setup

Test Function              : Emulate DTE
Clock Source               : External
Use X Clock                : No

Invert Clock               : No
Invert Data                : No

S (DCE) Clock Rate (bps): Unavail
X (DTE) Clock Rate (bps): Unavail
Use External Oscillator : No
```

Figure 2-2 Current Line Setup Window for X.21

The DA-3x automatically checks the clock lines for the presence of clock signals when you run the BERT Application. During this process, the text string "Determining line-speed..." is displayed at the bottom of the screen.

If a clock is present, its frequency is calculated and displayed in the clock rate fields. In addition, the text string "Line-speed detection done" is displayed at the bottom of the screen. Whenever an expected external clock signal is not detected, the "Unavail" text string is displayed instead.

2.1.2.2. T1

The Current Line Setup window for the T1 interface looks like the one shown in Figure 2-3.

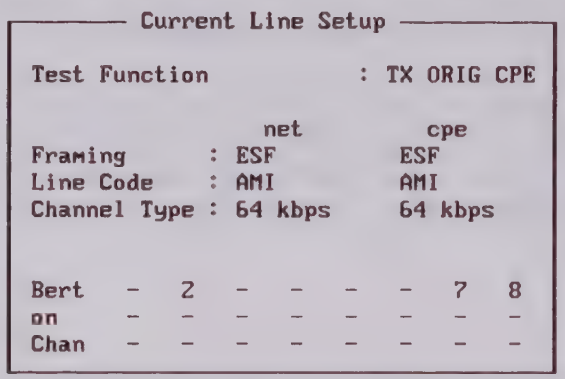

Current Line Setup
Test Function : TX ORIG CPE
net cpe
Framing : ESF ESF
Line Code : AMI AMI
Channel Type : 64 kbps 64 kbps
Bert - 2 - - - - 7 8
on - - - - - - - -
Chan - - - - - - - -

Figure 2-3 Current Line Setup Window for T1

This window reports the framing format, the line code, and the channel type for both sides of the interface (CPE and NET). It also provides a summary of the channels that are currently being used for BERT.

2.1.3. Current Transmitter Setup

The BERT Current Transmitter Setup window (Figure 2-4) appears when you run the application. BERT displays this window whenever you are at the BERT Main menu.

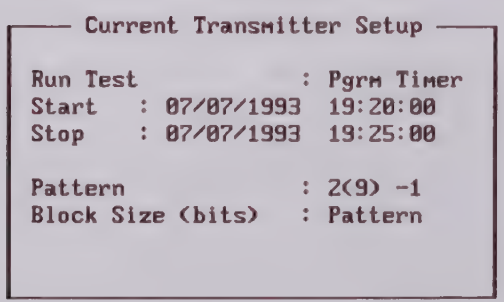

Current Transmitter Setup
Run Test : Pgrm Timer
Start : 07/07/1993 19:20:00
Stop : 07/07/1993 19:25:00
Pattern : 2(9) -1
Block Size (bits) : Pattern

Figure 2-4 Current Transmitter Setup Window

This window summarizes the current settings of the BERT transmitter. These settings can be modified via the Transmitter option on the Setup pull-down menu.

Table 2-2 describes the fields shown on the Current Transmitter Setup Window.

Current Transmitter Setup Field	Displays...
Run Test	one of the following text strings: "Continuous" when the BERT timer is in the Continuous mode "Stop Timer" when the BERT timer is in the Programmed Stop mode "Pgrm Timer" when the BERT timer is in the Programmed Start/Stop mode The modes of the BERT timer are discussed in Section 3.2.2.1, "Time Setting."
Duration	the test duration. This field appears only when the BERT timer is in the Programmed Stop mode. The date is shown in the mm/dd/yyyy format followed by the duration in the hh:mm:ss format. See Section 3.2.2.1, "Time Setting."
Start	the start time of the test. This field appears only when the BERT timer is in the Programmed Start/Stop mode. The date is shown in the mm/dd/yyyy format followed by the start time in the hh:mm:ss format. See Section 3.2.2.1, "Time Setting."
Stop	the stop time of the test. This field appears only when the BERT timer is in the Programmed Start/Stop mode. The date is shown in the mm/dd/yyyy format followed by the stop time in the hh:mm:ss format. See Section 3.2.2.1, "Time Setting."
Pattern	the selected test pattern expressed as a polynomial. See Section 3.2.2.2, "Patterns."
Block Size (bits)	the text string "Pattern" which indicates that the block size is the same as the pattern size. See Section 4.4, "BERT."

Table 2-2 Transmitter Setup Window Fields

2.1.4. Device Under Test

The Device Under Test status field underneath the Current Transmitter Setup window. This field reports the type of device that is being tested as shown in Table 2-3.

Test Status Message	Displayed when...
DCE under test	emulating a DTE. The Test Function is set to Emulate DTE on the Line Setup menu.
DTE under test	emulating a DCE. The Test Function is set to Emulate DCE on the Line Setup menu.
Mon under test	**X.21, V.24, V.35 and V.36 BERT Applications:** the Test Function—upon running the BERT Application—is set to Monitor on the Line Setup menu (accessed via the DA-3x Main Menu's interface slot window). However, because Monitor is not a valid Test Function setting for BERT, you are not allowed to perform a BERT until you change the Test Function to one of the emulation settings (e.g. Emulate DTE). **T1 BERT Application:** the Test Function—upon running the BERT Application—is set to RECEIVE ONLY on the Line Setup menu.
CPE under test	emulating a T1 network. The Test Function is set to TX ORIG NET or TX D&I NET on the Line Setup menu. For T1 only.
NET under test	emulating Customer Premises Equipment (CPE). The Test Function is set to TX ORIG CPE or TX D&I CPE on the Line Setup menu. For T1 only.

Table 2-3 Device Under Test Status

2.1.5. Prompt Line

The prompt line, displayed at the bottom of the screen provides information about key usage and explanations about current selections.

2.1.6. Online Help

Online help is provided for the BERT Application. A scrollable help screen is associated with each pull-down menu listed on the BERT Main menu bar. You can access these screens in one of two ways.

First, you can select the menu name and press the Help key. The same help screen is displayed whether you highlight only the menu's name or one of its options before pressing Enter.

Second, you can use the Help pull-down menu. The Help pull-down menu presents the choices listed in Table 2-4.

Help Option	Provides...
Getting Started	a brief description of the application. You can also access this screen by either highlighting the Help menu and pressing the Help key or by pressing the H (Help) key from any of the other help screens.
Keyboard	a list of the special keys and what they mean when used in the BERT Application.
About	general information about the application software such as the name, brief description, version number and copyright.

Table 2-4 On-line Help Options

2.1.7. Run Mode Softkey Rack

The Run Mode softkey rack, located at the bottom of the screen, consists of 10 softkeys labeled F1 to F10. These softkeys enable you to view various DA-3x displays and to change modes. The valid Run Mode softkeys for BERT and their associated functions are summarized in Table 2-5.

Softkey	Function
F1	Displays the Network Status screen.
F2	Displays the Character Trace screen.
F3	Displays the Protocol Trace softkey rack for the loaded protocols.
F5	Displays the Prompt Trace softkey rack. The Layer 1 prompt trace (F1) contains messages that are useful for tracking the activity of the BERT Application whenever you are uncertain of how the application is executing or you are trying to troubleshoot an abnormal condition.
F7	Displays the Display Window softkey rack. The Layer 1 Display Window contains the BERT Application screens.
F8	Switches between displaying the Run Mode and Exam Mode display screens for one analyzer or both analyzers simultaneously.
F9	Freezes the Run Mode display.
F10	The More key displays a second softkey rack that contains the following four softkeys: F1 changes to the current application's display window F2 switches to Exam Mode F3 switches to Menu Mode F4 goes to the currently defined DOS application

Table 2-5 Run Mode Softkeys and Their Functions

2.2. Procedure

To use BERT to test a DCE (local or remote) or a transmission channel, you need to perform the procedures listed below. Table 2-6 provides a reference for each procedure indicating where in this document you can find additional procedural information.

To do this...	Refer to...
Connect the DA-3x to the device to be tested	Section 1.5., "Connecting to the Device Under Test"
Load BERT	Section 1.6., "Loading and Running the BERT Application"
Run the application by pressing Alt-Run	Section 1.6., "Loading and Running the BERT Application"
Edit the WAN line interface or BERT transmitter setup and enable/disable loopback verification	Chapter 3, "BERT Test Setup"
Perform the BERT calculations	Chapter 4, "Performing the BERT"
View the results	Chapter 4, "Performing the BERT"

Table 2-6 Procedure for Testing with BERT

2.3. Setup Mode vs. Run Mode

BERT has two operational modes:

Setup mode — for configuring the line interface and BERT transmitter, enabling loopback verification and automatic loop delay adjustment, and setting the period for automatic printing of the statistics screen.

Run mode — for transmitting bit patterns, comparing received patterns, and calculating G.821 statistics.

When you load and run BERT, the application automatically places you in Setup mode. After completing the line and transmitter setup, you can go to Run mode by selecting one of the loopback options or the BERT option from the Run pull-down menu.

While the BERT test is being performed, BERT statistics are displayed on the application screen. Pressing Backspace always returns you to the application display window. If you are performing the BERT and want to return to the Current Setup screen, press Esc to stop the test and go to Setup mode.

BERT Test Setup

This chapter describes how to set up the WAN line interface and the BERT transmitter. It also describes how to enable/disable the loopback verification option as well as how to set the print interval for the automatic printing of the BERT statistics screen.

3.1. Overview of BERT Test Setup

Before performing the BERT, you need to make any necessary changes to the line and transmitter setup options. The options on the Setup pull-down menu allow you to set the emulation type, line speed; specify the clock source; select a BERT test pattern; and specify the test duration. This chapter provides information on these and other setup tasks.

You can run BERT using the default settings for all of these options or you can modify any or all of the values.

3.2. Setup

Figure 3-1 shows a sample Setup pull-down menu for the X.21 line interface. The options listed on the Setup menu depend on the WAN line interface that you have installed.

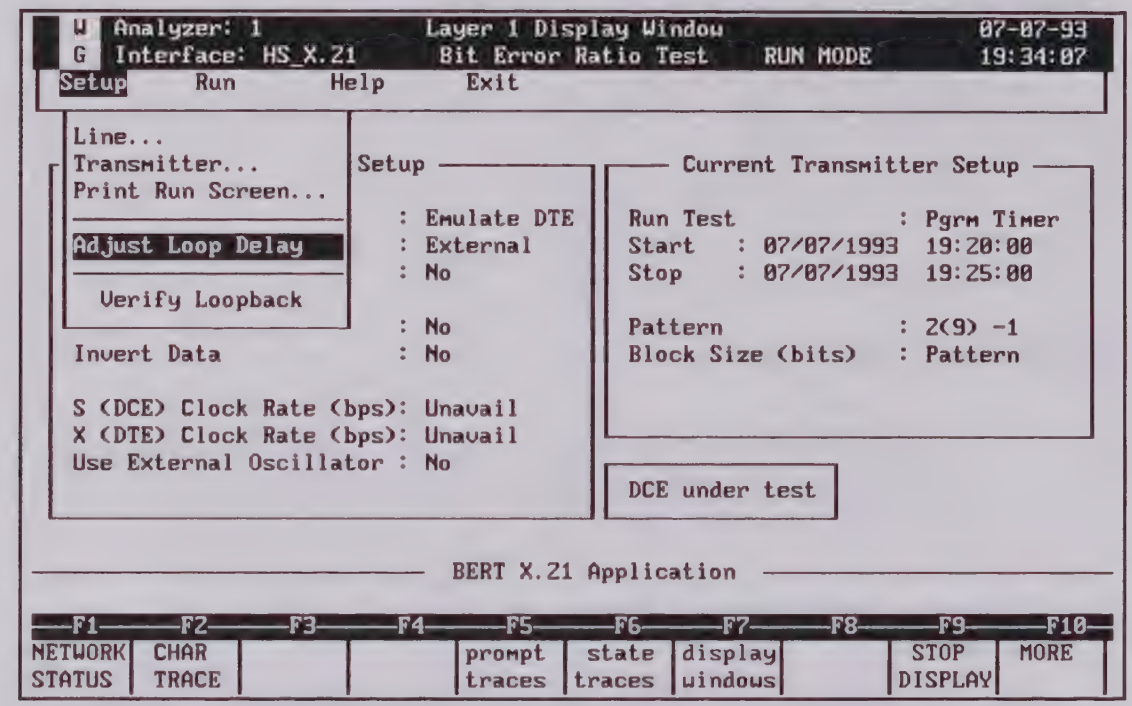


Figure 3-1 Setup Pull-down Menu

From the Setup pull-down menu, you can modify the following:

- Line Setup
- Transmitter Setup
- Print Run Screen
- Adjust Loop Delay (for X.21 only)
- Verify Loopback (for X.21 only)

To modify these parameters, highlight the appropriate selection and press Enter. Make the desired modifications and press Enter to return to the Setup pull-down menu. After making your changes, you can return to the BERT Main menu, from the Setup pull-down menu, by pressing Esc. The following sections provide information on the setup parameters.

3.2.1. Line Setup

The possible line setup options for the various line interfaces are shown and discussed in the following sections. The actual fields listed in the line setup window depend on the WAN line interface that you have installed. In any case, all fields shown are either toggle or data entry fields. For more detailed information on the fields for the various line interfaces, refer to the appropriate line interface section of the *DA-30/31 Line Interface Operation* binder.

3.2.1.1. X.21 Line Setup

Figure 3-2 shows the X.21 Line Setup Window and its default field settings.

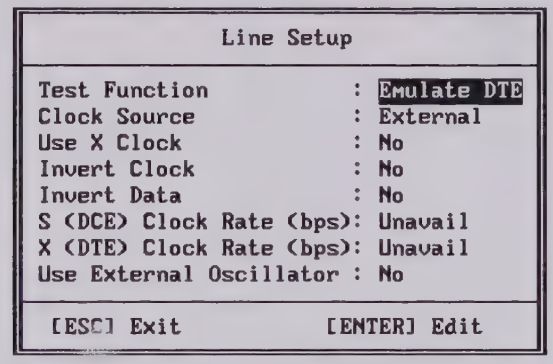

Line Setup
Test Function : Emulate DTE
Clock Source : External
Use X Clock : No
Invert Clock : No
Invert Data : No
S (DCE) Clock Rate (bps): Unavail
X (DTE) Clock Rate (bps): Unavail
Use External Oscillator : No
[ESC] Exit
[ENTER] Edit

Figure 3-2 X.21 Line Setup Window

The X.21 line setup options are listed in Table 3-1.

X.21 Line Setup Field	To modify...
Test Function	Toggle between Emulate DTE and Emulate DCE. Whenever this field is changed, the line speed is automatically re-determined before running BERT. Defaults to Emulate DTE.
Clock Source	Toggle between Internal and External. Whenever this field is changed, the line speed is automatically re-determined before running BERT. Defaults to External.
Use X Clock	Toggle between Yes and No. Defaults to No.
Invert Clock	Toggle between Yes and No. Defaults to No.
Invert Data	Toggle between Yes and No. Defaults to No.
S (DCE) Clock Rate (bps)	Defaults to the line speed of the WAN to which the DA-3x is connected when the clock source is external. When the clock source is internal, select from a table of standard clock rates (Figure 3-3). This field is related to the X (DTE) Clock Rate field. Thus, your selection here determines the rate of the X Clock and vice versa.
X (DTE) Clock Rate (bps)	Defaults to the line speed of the WAN to which the DA-3x is connected when the clock source is external. When the clock source is internal, select from a table of standard clock rates (Figure 3-3). This field is related to the S (DCE) Clock Rate field. Thus, your selection here determines the rate of the S Clock and vice versa.
Use External Oscillator	Toggle between Yes and No. Defaults to No.

Table 3-1 X.21 Line Interface Setup Fields

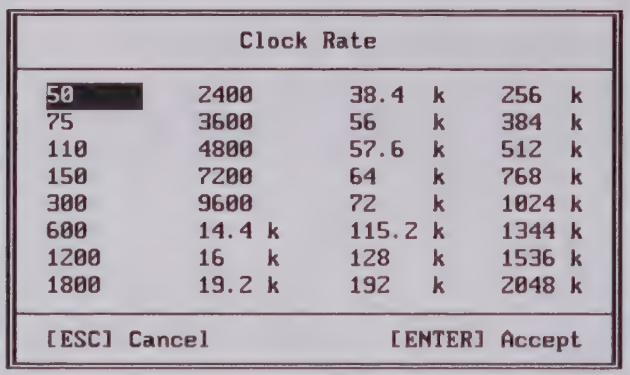


Figure 3-3 Clock Rate Selection Window

Kilobits per second is the unit used for those rates marked with a "k." For the others, the associated unit is bits per second.

3.2.1.2. V.24 & V.35 Line Setup

Figure 3-4 shows the V.24 and V.35 Line Setup Window and its default field settings.

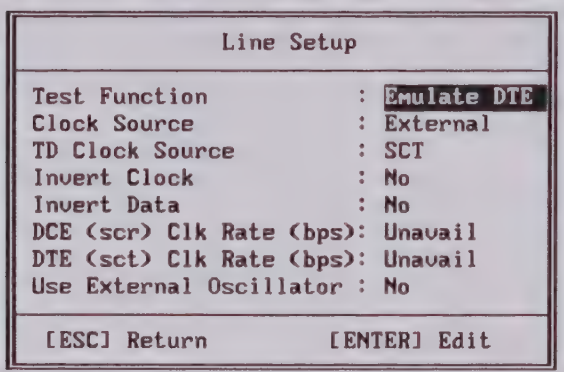

Line Setup
Test Function : Emulate DTE
Clock Source : External
TD Clock Source : SCT
Invert Clock : No
Invert Data : No
DCE (scr) Clk Rate (bps): Unavail
DTE (sct) Clk Rate (bps): Unavail
Use External Oscillator : No
[ESC] Return
[ENTER] Edit

Figure 3-4 V.24 and V.35 Line Setup Window

The V.24 and V.35 line setup options are listed in Table 3-2.

V.24/V.35 Line Setup Field	To modify...
Test Function	Toggle between Emulate DTE and Emulate DCE. Whenever this field is changed, the line speed is automatically re-determined before running BERT. Defaults to Emulate DTE.
Clock Source	Toggle between Internal and External. Whenever this field is changed, the line speed is automatically re-determined before running BERT. Defaults to External.
TD Clock Source	Toggle between SCT and SCTE. Defaults to SCT.
Invert Clock	Toggle between Yes and No. Defaults to No.
Invert Data	Toggle between Yes and No. Defaults to No.
DCE (scr) Clk Rate (bps)	Defaults to the line speed of the WAN to which the DA-3x is connected when the clock source is external. When the clock source is internal, select from a table of standard clock rates (Figure 3-3). This field is related to the DTE (sct) Clock Rate field. Thus, your selection here determines the rate of the DTE Clock and vice versa.
DTE (sct) Clk Rate (bps)	Defaults to the line speed of the WAN to which the DA-3x is connected when the clock source is external. When the clock source is internal, select from a table of standard clock rates (Figure 3-3). This field is related to the DCE (scr) Clock Rate field. Thus, your selection here determines the rate of the DCE Clock and vice versa.
Use External Oscillator	Toggle between Yes and No. Defaults to No.

Table 3-2 V.24 & V.35 Line Interface Setup Fields

Caution:

Operating the V.24 line interface at clock rates greater than 19.2 k is not recommended. Although higher clock rates are possible, the BERT_V24 application may give you unpredictable and unreliable results.

3.2.1.3. V.36 Line Setup

Figure 3-5 shows the V.36 Line Setup Window and its default field settings.

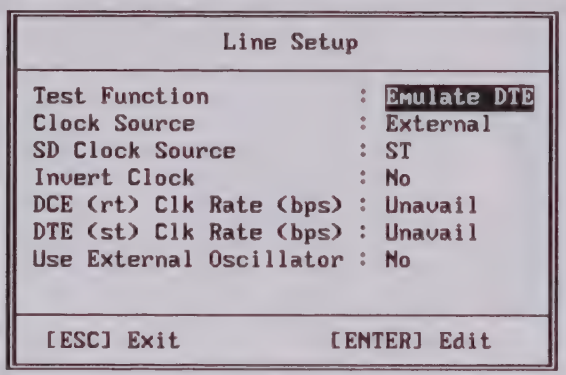

Line Setup
Test Function : Emulate DTE
Clock Source : External
SD Clock Source : ST
Invert Clock : No
DCE (rt) Clk Rate (bps) : Unavail
DTE (st) Clk Rate (bps) : Unavail
Use External Oscillator : No
[ESC] Exit
[ENTER] Edit

Figure 3-5 V.36 Line Setup Window

The V.36 line setup options are listed in Table 3-3.

V.36 Line Setup Field	To modify...
Test Function	Toggle between Emulate DTE and Emulate DCE. Whenever this field is changed, the line speed is automatically re-determined before running BERT. Defaults to Emulate DTE.
Clock Source	Toggle between Internal and External. Whenever this field is changed, the line speed is automatically re-determined before running BERT. Defaults to External.
SD Clock Source	Choose either ST, TT and RT. Defaults to ST.
Invert Clock	Toggle between Yes and No. Defaults to No.
Invert Data	Toggle between Yes and No. Defaults to No.
DCE (scr) Clk Rate (bps)	Defaults to the line speed of the WAN to which the DA-3x is connected when the clock source is external. When the clock source is internal, select from a table of standard clock rates (Figure 3-3). This field is related to the DTE (sct) Clk Rate field. Thus, your selection here determines the rate of the DTE Clock and vice versa.
DTE (sct) Clk Rate (bps)	Defaults to the line speed of the WAN to which the DA-3x is connected when the clock source is external. When the clock source is internal, select from a table of standard clock rates (Figure 3-3). This field is related to the DCE (scr) Clk Rate field. Thus, your selection here determines the rate of the DCE Clock and vice versa.
Use External Oscillator	Toggle between Yes and No. Defaults to No.

Table 3-3 V.36 Line Interface Setup Fields

3.2.1.4. T1 Line Setup

Figure 3-6 shows the T1 Line Setup Window and its default field settings.

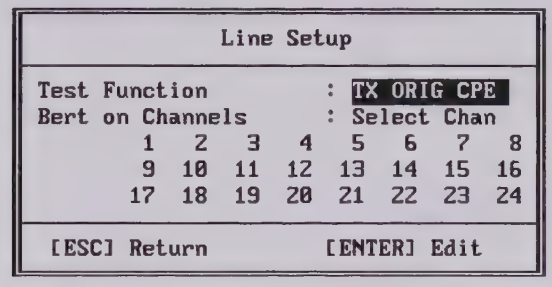

Line Setup
Test Function : TX ORIG CPE
Bert on Channels : Select Chan
1 2 3 4 5 6 7 8
9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24
[ESC] Return [ENTER] Edit

Figure 3-6 T1 Line Setup Window

The T1 line setup options are listed in Table 3-4.

T1 Line Setup Field	To modify...
Test Function	This is an auto-selecting field. Upon running the BERT Application, this field defaults to the Test Function setting on the Line Setup menu (accessed via the DA-3x Main Menu's interface slot window). The following message is displayed as a reminder at the bottom of the screen if you try to make a Test Function selection: "TEST FUNCTION may only be changed from LINE INTERFACE SETUP menu." The valid settings are: TX ORIG CPE, TX D&I CPE, and RECEIVE ONLY. The BERT Application does not support the TX ORIG NET and TX D&I NET settings.
Bert on Channels	Select from a list of 24 channels. Figure 3-7 shows the available channels. Defaults to all channels being selected.

Table 3-4 T1 Line Interface Setup Fields

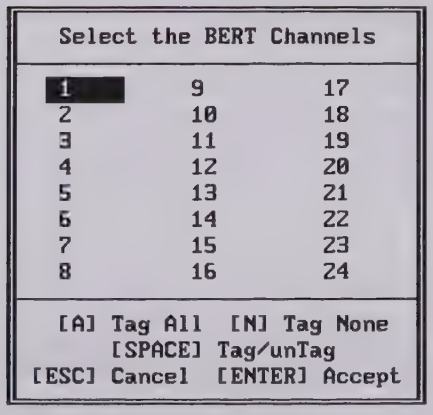


Figure 3-7 BERT Channels Selection Box

Pressing the Spacebar on a highlighted channel selection tags/untags it. Once a channel has been tagged, an asterisk is displayed next to the channel number on the Select the BERT Channels list and the channel number is simultaneously displayed in the appropriate channel position on the Line Setup window. To tag all the channels at once, press A. To untag all the channels at once, press N.

3.2.2. Transmitter Setup

Figure 3-8 shows the Transmitter Setup window. This window allows the user to set the start time and test duration using the Time Setting option and select a test pattern using the Patterns option.

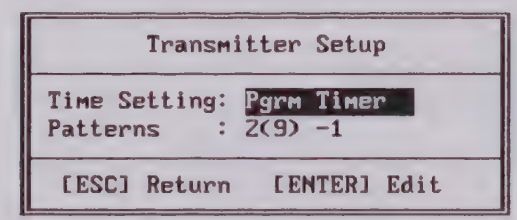


Figure 3-8 Transmitter Setup Window

3.2.2.1. Time Setting

This field allows you to program the BERT timer. The BERT timer has three modes of operation: continuous, programmed stop and programmed start/stop. Select the Time Setting field, and press Enter. The Time Setting window appears, as shown in Figure 3-9, presenting you with the three choices.

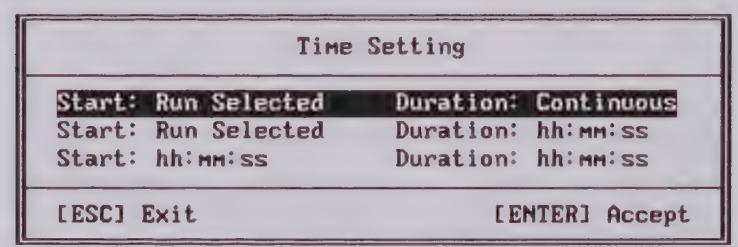

Time Setting
Start: Run Selected Duration: Continuous
Start: Run Selected Duration: hh:mm:ss
Start: hh:mm:ss Duration: hh:mm:ss
[ESC] Exit [ENTER] Accept

Figure 3-9 Time Setting Window

Note:

All time entries are based on the 24-hour clock. The BERT timer does not provide for setting the date. Consequently, time settings always refer to the current date.

Follow the steps listed for one of the following three modes to set the start time and/or duration.

Continuous Mode:

You want the BERT to start as soon as the DA-3x enters the BERT Run mode and to run continuously.

1. Position the cursor on the **Start: Run Selected Duration: Continuous** selection.
2. Press Enter to return to the Transmitter Setup window. The Time Setting field displays "Continuous."

Programmed Stop Mode:

You want the BERT to start as soon as the DA-3x enters the BERT Run mode and to stop running after a certain period of time. The BERT Application beeps twice at the completion of the BERT.

1. Position the cursor on the **Start: Run Selected Duration: hh:mm:ss** selection.
2. Press Enter to display a Clock Time Setting dialog box that prompts you for the test duration (Figure 3-10).

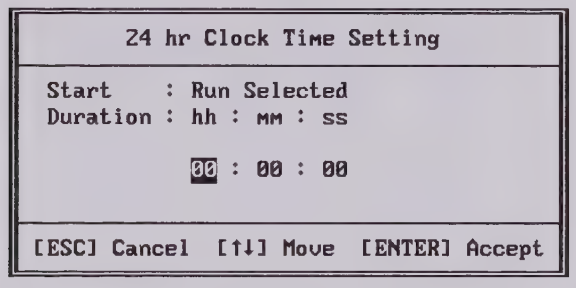


Figure 3-10 Dialog Box for the "Start: Run Selected Duration: hh:mm:ss" Option

3. The test duration is entered in the hh:mm:ss format. Using the Up/Down Arrow keys, position the cursor on the desired Duration time field: hh (hours), mm (minutes) or ss (seconds). The Down Arrow key moves the cursor one field to the right while the Up Arrow key moves the cursor one field to the left.
4. Enter a value for the selected field. After entering the desired test duration, press Enter to return to the Transmitter Setup window. The Time Setting field displays "Stop Timer."

   If you decide that you do not want to change the time setting, press Esc. You return to the Transmitter Setup window without making any changes.

Programmed Start/Stop Mode:

You want the BERT to start at a certain time after the DA-3x enters the BERT Run mode and to stop running after a certain period of time. The BERT Application beeps twice at the completion of the BERT.

1. Position the cursor on the **Start: hh:mm:ss Stop: hh:mm:ss** selection.
2. Press Enter to display a Clock Time Setting dialog box that prompts you for the start time and test duration (Figure 3-11).

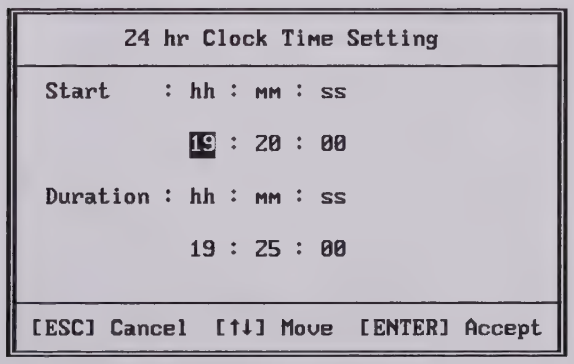


Figure 3-11 Dialog Box for the "Start: hh:mm:ss Stop: hh:mm:ss" Option

3. The start time is entered in the hh:mm:ss format. Using the Up/Down Arrow keys, position the cursor on the desired Start time field: hh (hours), mm (minutes) or ss (seconds). The Down Arrow key moves the cursor one field to the right while the Up Arrow key moves the cursor one field to the left.
4. Enter a value for the selected field. After entering the desired start time, either press Enter to return to the Transmitter Setup window or go on to set the test duration (Step 5). Pressing the Down Arrow key, while the ss field is selected, moves the cursor to the first Duration time field (hh).
5. The test duration is entered in the hh:mm:ss format. Using the Up/Down Arrow keys, position the cursor on the desired Duration time field: hh (hours), mm (minutes) or ss (seconds). The Down Arrow key moves the cursor one field to the right while the Up Arrow key moves the cursor one field to the left. Pressing the Up Arrow key, while the hh field is selected, moves the cursor to the last Start time field (ss).
6. Enter a value for the selected field. After entering the desired test duration, press Enter to return to the Transmitter Setup window. The Time Setting field displays "Pgrm Timer" to indicate that the BERT is under programmed control.

Note:

When editing a time field that has been cleared (contains 00), the first digit you type replaces the digit in the left position. Any subsequent digit you type replaces the digit in the right position.

When editing a time field that already contains a value, the digit you type replaces the digit in right position only. In order to modify the digit in the left position, you must, first, clear both digit positions by using the Backspace key and then type the desired two-digit number. Again, the first digit you type replaces the digit in the left position. Any subsequent digit you type replaces the digit in the right position.

If you decide that you do not want to change the time setting, press Esc. You return to the Transmitter Setup window without making any changes.

Upon entering the BERT Run mode, the application displays an alert message (Figure 3-12) indicating that the BERT timer has been programmed to start at a specified time.

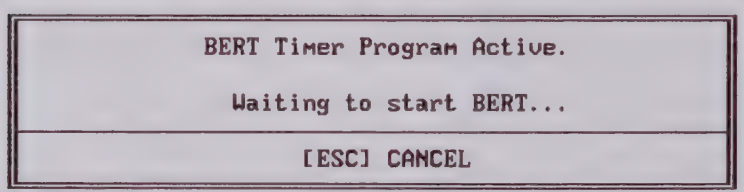


Figure 3-12 Programmed Start Alert Message

3.2.2.2. Patterns

This field displays the specific test pattern being used.

To select a BERT test pattern, follow these steps:

1. Select the Patterns field, and press Enter. The pattern selection window shown in Figure 3-13 appears.

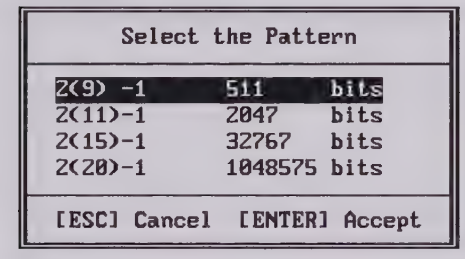


Figure 3-13 Pattern Selection Window

The pattern selection window lists the supported patterns and their corresponding bit lengths. Each pattern is given in the form of a polynomial as follows:

2(n) - 1 where n is the exponent of 2.

2. Using the Up/Down Arrow keys, position the cursor on the desired pattern. Press Enter to select it and return to the Transmitter Setup window. The Patterns field displays the pattern's polynomial.

   If you decide that you do not want to change the test pattern, press Esc. You return to the Transmitter Setup window without making any changes.

3.2.3. Print Run Screen

Figure 3-14 shows the Print Screen Period selection window. This window allows you to set the enable/disable automatic printing of the BERT Statistics screen. It also allows you to select the print period (time interval between screen prints).

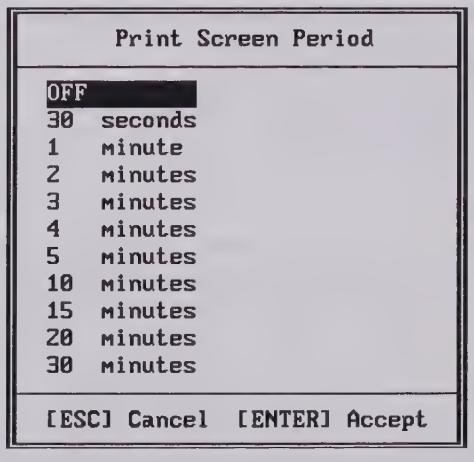


Figure 3-14 Print Screen Period Selection Window

To enable automatic printing, follow these steps:

1. Using the Up/Down Arrow keys, position the cursor on the desired print interval.
2. Press Enter to select the print period and return to the Setup pull-down menu.

To disable automatic printing, follow these steps:

1. Using the Up Arrow key, position the cursor on the OFF selection.
2. Press Enter to disable automatic printing and return to the Setup pull-down menu.

If you decide that you do not want to change the print period or the enable/disable status of automatic printing, press Esc. You return to the Setup pull-down menu without making any changes.

3.2.4. Adjust Loop Delay (for X.21 only)

Loop delay adjustment is meaningful only in cases where one of the loopback test configurations is being used and Verify Loopback is enabled. The Verify Loopback toggle is discussed in Section 3.2.5, "Verify Loopback."

When performing a loopback BERT, the DA-3x sends loopback initialization commands to the DCE (local or remote). In order to verify that the DCE is in the loopback mode before running BERT, the DA-3x searches for a loopback confirmation. This confirmation is the reception of the initialization test frame that was transmitted to the DCE.

The amount of time that the DA-3x waits for the return of the initialization test frame is known as the loop delay. A time-out occurs when the DA-3x does not receive the test initialization frame within the loop delay period. If this happens, the loop delay can be adjusted until an appropriate delay is achieved. The BERT Application allows for both manual and automatic loop delay adjustment. This section describes manual adjustment. Automatic loop delay adjustment is described later in Chapter 4 (Section 4.2, "Local LoopBack").

Figure 3-15 shows the Manual Loop Delay Adjustment window.

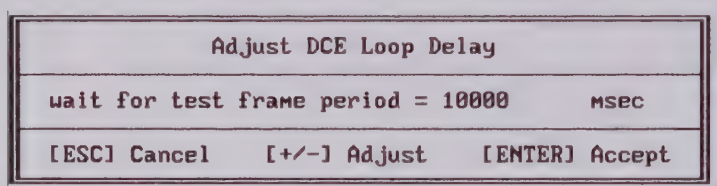


Figure 3-15 Manual Loop Delay Adjustment Window

The value that follows the "wait for test frame period =" string represents the current loop delay time-out value.

The default time-out value is 10,000 milliseconds. However, different modems (DCEs) will have different loop delays associated with them due to different line speeds, inherent device delays, etc. If you know what delay to expect, then you can manually adjust the loop delay in this window.

To manually adjust the loop delay time-out value, follow these steps:

1. Using the +/- keys, increment/decrement the loop delay time-out value in 50 millisecond steps. The maximum value for the loop delay time-out is 30,000 milliseconds. The minimum value is 500 milliseconds.
2. Press Enter to set the new loop delay value and return to the Setup pull-down menu.

   If you decide that you do not want to change the loop delay value, press Esc. You return to the Setup pull-down menu without making any changes.

3.2.5. Verify Loopback (for X.21 only)

The Verify Loopback is a toggle selection. It is used to verify that the DCE (local or remote) is in the loopback mode before running the BERT. When Verify Loopback is enabled, the DA-3x sends the initialization test frame to the DCE and then waits for a loopback confirmation from the DCE (local or remote) before running the BERT. When Verify Loopback is disabled, the DA-3x sends the initialization test frame to the DCE and starts running BERT without waiting for loopback confirmation from the DCE.

To enable/disable loopback verification, follow these steps:

1. Using the Up/Down Arrow keys, position the highlight bar on the Verify Loopback selection.

   Figure 3-16 shows the Verify Loopback selection when loopback verification has been enabled.

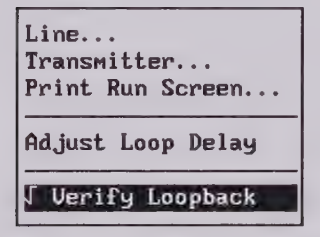
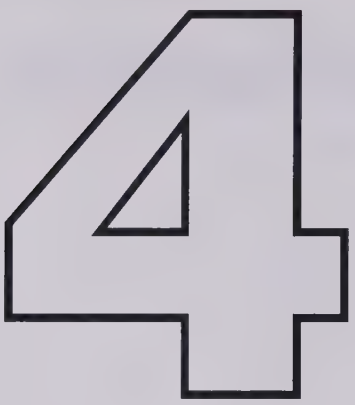


   Figure 3-16 Verify Loopback: Enabled

   When enabled, a √ symbol appears to the left of the selection. When disabled, nothing appears to the left of the selection.

2. Press Enter to enable/disable loopback verification. If loopback verification is not already enabled, pressing Enter enables it. Otherwise, pressing Enter disables it.



Performing the BERT

This chapter provides information on performing BERT. It also provides information on performing loopback initialization for a local and a remote DCE.

4.1. Overview of the Test

Before running the BERT, make sure you have made all necessary changes to the line setup and the transmitter setup. For more information on BERT test setup, refer to Chapter 4, "BERT Test Setup."

The BERT Application Run pull-down menu provides three options:

- Local LoopBack (for X.21 & V.24 only)
- Remote LoopBack (for X.21 & V.24 only)
- BERT

The Run pull-down menu is shown in Figure 4-1.

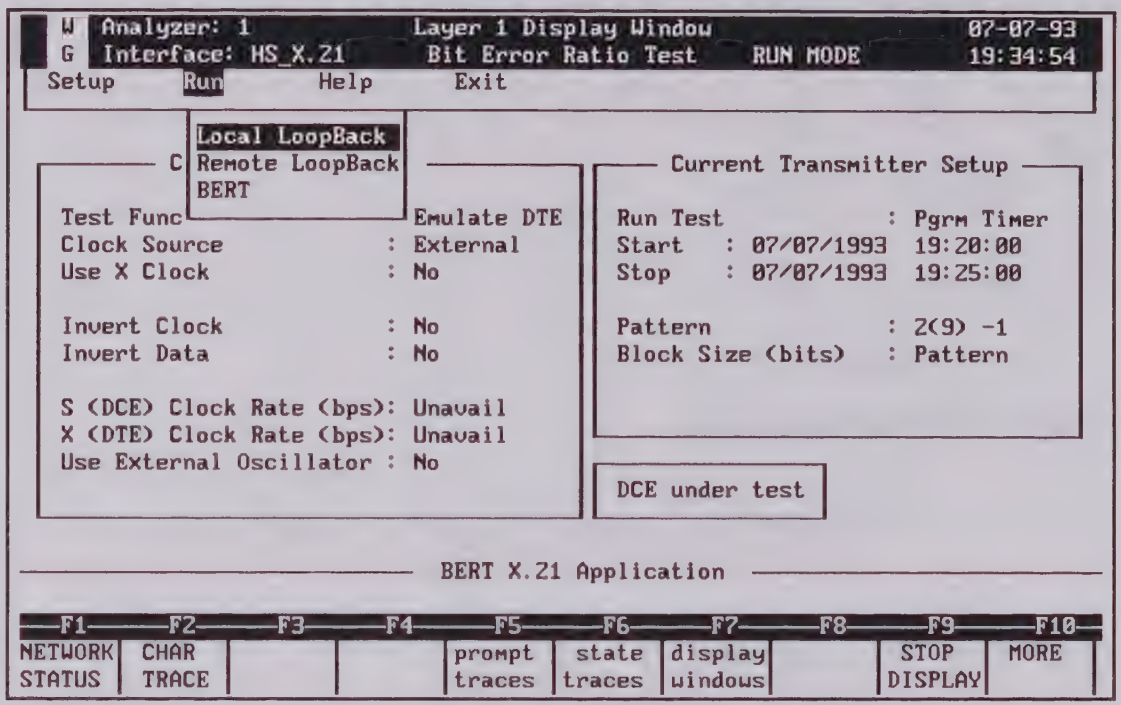


Figure 4-1 Run Pull-down Menu

The following sections provide information on these options along with the on-screen results of the tests.

4.2. Local LoopBack (for X.21 & V.24 only)

This selection causes the DA-3x to initialize the local DCE for loopback before running the BERT. Be sure your test setup is in a local loopback configuration and the DA-3x is setup for DTE emulation before making this selection.

To perform local loopback initialization, follow these steps:

1. Using the Up/Down Arrow keys, position the highlight bar on the Local LoopBack selection.
2. Press Enter to start local loopback initialization.

   If you decide that you do not want to perform local loopback, press Esc. You return to the BERT Main menu.

   If the DA-3x is not setup for DTE emulation, a warning message (Figure 4-2) is displayed.

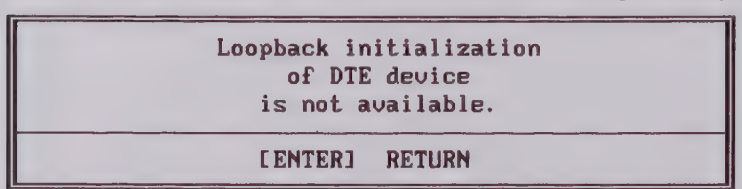


Figure 4-2 Warning Message: Loopback Not Available at DTE

If loopback verification is enabled (Verify Loopback selected) and the DA-3x does not receive loopback confirmation, the message shown in Figure 4-3 is displayed.

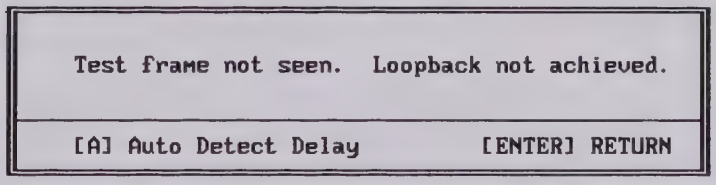


Figure 4-3 Message: Loopback Not Achieved

You can respond by pressing one of the two keys listed in Table 4-1.

Key	Action
A	the BERT Application attempts to automatically detect the loop delay from the DCE. The application searches for a suitable loop delay by alternately incrementing and decrementing (in 50 millisecond steps) the default delay of 10,000 milliseconds. An Automatic Loop Delay Adjustment window is displayed as shown in Figure 4-4. It is similar to the window described in Section 3.2.4, "Adjust Loop Delay."
Enter	returns you to the BERT Main menu.

Table 4-1 Responses: Loopback Not Achieved

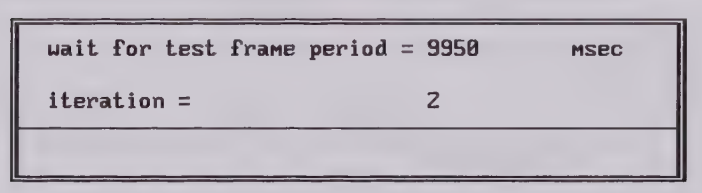


Figure 4-4 Automatic Loop Delay Adjustment Window

The fields of the Automatic Loop Delay Adjustment window are listed in Table 4-2.

Field	Indicates...
wait for test frame period =	the current loop delay value
iteration =	the current iteration of the automatic loop delay adjustment routine

Table 4-2 Fields of the Automatic Loop Delay Adjustment Window

If a suitable delay is found, a message—telling you that the loop delay (time-out) has been calculated—is displayed on the Automatic Loop Delay Adjustment window. See Figure 4-5. Press Enter to accept the loop delay value.

Sometimes, the loop delay search will return a value which, when used, does not fit the loopback verification specifications. In this case, simply disable loopback verification (Section 3.2.5, "Verify Loopback").

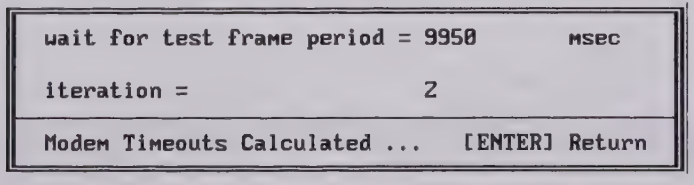


Figure 4-5 Automatic Loop Delay Adjustment Window: Suitable Delay Found

If the BERT Application cannot find a loop delay value that is less than or equal to 30,000 milliseconds (30 seconds) and greater than 500 milliseconds (0.5 seconds), it stops searching for loop delays and returns to the BERT Main menu.

Note:

Because various modems can have widely varying loop delay requirements, the automatic loop delay adjustment routine is not guaranteed to find a loop delay value that matches that of the modem you are testing. Therefore, if the loop delay search goes on for longer than you think is appropriate, simply press Esc to abort.

4.3. Remote LoopBack (for X.21 & V.24 only)

This selection functions in much the same way as the Local LoopBack selection. The only difference is that a remote—rather than local—loopback initialization is performed. This selection causes the DA-3x to initialize the remote DCE for loopback before running the BERT. Be sure your test setup is in a remote loopback configuration before making this selection.

To perform remote loopback initialization, follow these steps:

1. Using the Up/Down Arrow keys, position the highlight bar on the Remote LoopBack selection.
2. Press Enter to start remote loopback initialization.

   If you decide that you do not want to perform remote loopback, press Esc. You return to the BERT Main menu.

The DA-3x must be setup for DTE emulation in order to perform loopback. If not, a warning message (Figure 4-6) is displayed.

Figure 4-6 Warning Message: Loopback Not Available at DTE

If loopback verification is enabled (Verify Loopback selected) and the DA-3x does not receive loopback confirmation, the same messages and windows described in Section 4-2, "Local LoopBack" are displayed.

Note:

Version 1.0 of the BERT Application does not support software-initialized loopback for the V.35 and V.36 interfaces—only X.21 and V.24.

4.4. BERT

The BERT computes standard BERT statistics as defined in the CCITT G.821 Recommendation.

Before running BERT, be sure the device under test is also in the BERT mode. You should also be sure the Test Function field on the BERT Line Setup menu is set to one of the emulation settings. If it is not, the application will not allow you to perform a BERT, and a message box appears displaying the following warning:

"BERT cannot run unless configured for EMULATE"

If emulating a DTE, be sure the interface clocks are present. If they are not, the warning message shown in Figure 4-7(a) is displayed. If emulating a DCE, be sure that you have selected clock rates from the Clock Rate selection boxes. If you have not and leave the clock rate fields set to "Unavail," the warning message shown in Figure 4-7(b) is displayed.

```
DCE clock is not available.

[ENTER]  RETURN
```

Figure 4-7(a) No Clock Warning Message (when emulating a DTE)

```
No Clock Rate detected.  Cannot enter BERT.

[ENTER]  RETURN
```

Figure 4-7(b) No Clock Warning Message (when emulating a DCE)

The BERT Statistics screen is shown in Figure 4-8.

```
W Analyzer: 1          Layer 1 Display Window                  07-07-93
G Interface: HS_X.21    Bit Error Ratio Test    RUN MODE        19:45:18
                                                          Sync = ON
 BERT (G.821) Stats        Total          Ratio        Status
 ------------------        -----          -----        ------
 Test Seconds              3.5  E+01                   Elapsed Time: 00:00:36
 Blocks Received           0.0                         Pattern     : 2(9) -1
 Bits Received             1.4  E+01                   Block Size  : Pattern

 Bit Errors                0.0             0.0        Line Rate : 9600    bps
 Blocks in Error           0.0             0.0        Prn Intrvl: OFF

 Available Seconds         3.5  E+01       1.0  E+02
 Available Minutes         5.833E-01       1.0  E+02

 Degraded Minutes          0.0             0.0        Passed ( < 10 %  )
 Severely Errored Seconds  0.0             0.0        Passed ( < 0.2 % )
 Errored Seconds           0.0             0.0        Passed ( < 8 %   )

[ESC] Stop     [R] Reset Statistics     [I] Insert Bit Error     [P] Print Screen
                          BERT X.21 Application

 F1        F2        F3    F4    F5          F6          F7          F8    F9        F10
 NETWORK   CHAR                  prompt      state       display           STOP      MORE
 STATUS    TRACE                 traces      traces      windows           DISPLAY
```

Figure 4-8 BERT Statistics Screen

In the upper right corner of the screen, a synchronization status field reports synchronization status as shown in Table 4-3.

Synchronization Status	Meaning
Sync = ON	Synchronization between the DA-3x and the device under test (DTE or DCE) has been achieved.
Sync = OFF	Synchronization between the DA-3x and the device under test (DTE or DCE) has either been interrupted or has not yet been achieved. In the case of a loss of synchronization, all BERT statistics (discussed later) are frozen at their values prior to instant synchronization was lost. The counts are resumed as soon as synchronization is restored.

Table 4-3 Synchronization Status

The synchronization status determination is based on a percentage of bit errors detected during any given one-second interval. When this percentage exceeds a certain threshold, the BERT Application determines that synchronization on the transmission line has been interrupted (Sync = OFF). The synchronization threshold varies depending on the BERT test pattern being used. Table 4-4 lists the various threshold values.

Pattern Selection	Synchronization Threshold
2(9) - 1	20 %
2(11) - 1	15 %
2(15) - 1	15 %
2(20) - 1	1 %

Table 4-4 Synchronization Threshold Values

In the case of BERT_T1, a loss of framing does not necessarily cause a loss of synchronization. If the Framing field on the T1 Current Line Setup window is set to ESF (or ESFz) and a data stream that uses another framing method (e.g. UNFRAMED) is received, BERT_T1 will not lose synchronization. Although this results in a large number of bit and block errors, the rate of these errors is not high enough to cause BERT_T1 to lose synchronization.

Note:

When using any of the patterns larger than 2(11) - 1, be sure that you are running at one of the higher clock rates (i.e. greater than 256 k). Otherwise, line synchronization may never be achieved.

The rest of the screen is divided into four columns: BERT (G.821) Stats, Total, Ratio, and Status. The BERT (G.821) column reports the field name for each of the standard BERT statistics.

Table 4-5 provides information on the fields displayed on the BERT Statistics screen. Each of the statistics are updated every second.

Field	Indicates...
Test Seconds	The number of seconds that have elapsed since achieving synchronization (Sync = ON) between the DTE and DCE. If synchronization is lost (Sync = OFF), this count is stopped. The count resumes when synchronization is restored.
Blocks Received	The number of blocks received from the line.
Bits Received	The number of bits received from the line.
Bit Errors	The number of bit errors detected (Total column). The ratio (BER) of Bit Errors to Bits Received (Ratio column).
Blocks in Error	The number blocks in which 1 or more bit errors have been detected (Total column). The ratio of Blocks in Error to Blocks Received (Ratio column)
Available Seconds	The difference between Test Seconds and Unavailable Seconds (Total column). Unavailable Seconds are internally monitored and are not displayed. An unavailable second is defined as a one-second interval in which the BER is greater than or equal to 1×10^{-3}. However, the occurrence of ten consecutive seconds in which the BER does not equal or exceed 1×10^{-3} is considered available time. When this happens, the Unavailable Seconds count is decremented by 10, and the Severely Errored Seconds count is incremented by 10. The ratio of Available Seconds to Test Seconds multiplied by 100 (Ratio column).
Available Minutes	The Available Seconds represented as minutes (Total column). The ratio of Available Minutes to Test Seconds multiplied by 6000 (Ratio column).
Degraded Minutes	The number of available 60-second intervals—excluding Severely Errored Seconds—in which the BER exceeded 1×10^{-6} (Total column). The ratio of Degraded Minutes to Available Minutes multiplied by 100 (Ratio column).
Severely Errored Seconds	The number of one-second intervals in which the BER is greater than or equal to 1×10^{-3} (Total column). However, the occurrence of 10 consecutive severely errored seconds is considered unavailable time. When this happens, this count is decremented by 10, and the Unavailable Seconds counter is incremented by 10. The ratio of Severely Errored Seconds to Available Seconds multiplied by 100 (Ratio column).
Errored Seconds	The number of one-second intervals in which the BER was between 0 and 1×10^{-3} (Total column). The ratio of Errored Seconds to Available Seconds multiplied by 100 (Ratio column).

Table 4-5 BERT Statistics Screen Fields

The Total column reports the total counts associated with each of the statistics fields in the following scientific notation format (to four significant figures):

0.0000E+/-00

The Ratio column reports the ratios for the Bit Errors, Blocks in Error, Available Seconds, Available Minutes, Degraded Minutes, Severely Errored Seconds, and Errored Seconds fields. These ratios are reported as percentages in the scientific notation format (to four significant figures).

There are two text strings that may also appear in the Ratio column: "NaN" (Not a Number) and "Inf" (Infinity). "NaN" is displayed whenever the ratio evaluates to an indeterminate value (e.g. result of a division by zero). "Inf" is displayed whenever the ratio evaluates to a number too large to be represented in the scientific notation format.

The Status column reports:

- Elapsed Time: The amount of time that has elapsed since entering Run Mode.
- Pattern: The test pattern being used—expressed as a polynomial
- Block Size: The size (in bits) of a block. This field displays the text string "Pattern" because the block size defaults to the size of the test pattern. Table 4-6 shows the number of bits that correspond to the available patterns.

Pattern	Block Size (bits)
2(9) - 1	511
2(11) - 1	2047
2(15) - 1	32767
2(20) - 1	1048575

Table 4-6 Block Sizes for Test Patterns

- # of Chan: The number of channels operating at the rate shown in the Line Rate field. This field is shown only when running the BERT_T1 application.
- Line Rate: The clock rate as set on the Clock Rate Selection window (Figure 3-3) or detected on the line. If running the BERT_T1 application, the line rate is displayed in "kbps" (kilobits per second). For the other interfaces, the line rate is displayed in "bps" (bits per second).
- Prn Intrvl: The print period as set on the Print Screen Period selection window (Figure 3-14).
- The Pass/Fail status of the following fields: Degraded Minutes, Severely Errored Seconds, and Errored Seconds. Table 4-7 shows the possible status messages and their meaning.

Field	Status Message	Indicates...
Degraded Minutes	Passed (< threshold 10%)	the ratio is less than the G.821 10% threshold.
Severely Errored Seconds	Passed (< threshold 0.2%)	the ratio is less than the G.821 0.2% threshold.
Errored Seconds	Passed (< threshold 8%)	the ratio is less than the G.821 8% threshold.

Table 4-7 G.821 Threshold Values

At the bottom of this screen, a few important keys are listed. These keys have special functions while you are performing the BERT. See Table 4-8.

Key	Function
Esc	stops performing the BERT and returns you to the BERT Main menu
R	resets all the BERT statistics
I	inserts a single bit error into the data stream
P	outputs the BERT Statistics screen to a printer

Table 4-8 Relevant Keys for the BERT

PREFACE

This document provides information about the T1 applications available with Release 3.4.1. Each application includes a description of:

- the LIP's and LPP's necessary to run the application
- what the application does
- when to use the application
- setup instructions
- how to use the application
- directions for viewing results
- directions for exiting the program

On-line application notes are available for each application. These notes provide a description of the application, and explain when and why to use the application. Additional T1 applications, which run with Frame Relay, are described in the Frame Relay Application Notes document.

This document assumes a basic knowledge of the DA-3x. Refer to the *DA-30 /31 Operating Manual* for detailed DA-3x operating instructions.

Note:

Each W&G application is designed to solve a specific type of network problem. Because each network's troubleshooting needs are unique, the DA-3x provides you with the capability to customize applications (or develop your own) to suit your particular needs. If you change the setup of a W&G application, for example, by altering the loaded protocols or data logging, you must make corresponding changes to the application's Network Event Program. If you do not make these changes, the application may produce unpredictable results. Adding protocols may adversely affect application performance.

W&G provides custom applications. If you have specific application requirements, contact your sales representative to discuss a solution.

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MONT1 Monitor T1 1
BERT_T1 Bit Error Ratio Test on T1

Application Name	Application Description
MONT1	Monitor T1
MONHS_T1	Monitor T1

Detailed Program Description

Loaded Layer Protocol Packages: None

This application monitors a Bit Oriented Protocol running on a T1 interface. It provides Network Status information about the network running the protocol. A Character Trace display shows the frame data sent and received on the network. This application can run on either a Standard or High-Speed T1 Line Interface and it is the default application for T1. The DA-3x automatically loads this application upon power-up if T1 is the first interface loaded in Slots 4-7.

Setup: For passive monitoring of one line side, where the DA-3x is used to access the data from the T1 for the purpose of protocol analysis at upper layers, you need only the IN side of the Bantam connection (or the receive pair on the RJ48C). A single Bantam connection to the TO NET IN or TO CPE OUT connector forwards the data from the one side of the line (the side going from the NET to the CPE) to the DA-3x for analysis. A single Bantam connection to the TO NET OUT or TO CPE IN connector accesses the data from the other side of the line (from the CPE to the NET).

To access data from both line sides simultaneously, you need either two Bantam connections (TO NET IN and TO NET OUT, or TO CPE IN and TO CPE OUT) or a single RJ48C connection to either TO CPE or TO NET.

Input: None required.

Results: View network information in the Network Status or Character Trace Display Windows.

Program Exit: Press Alt-Menu to return to the DA-3x Main Menu. Press Alt-Exam to go to Examine Mode.

Bit Error Ratio Test Application for T1

(BERT_T1)

PREFACE

Purpose and Scope

This document describes how to load and operate the Bit Error Ratio Test (BERT) Application which runs on the Wandel & Goltermann DA-3x Protocol Analyzer. The BERT Application allows you to perform loopback and bit error testing on transmission lines, Wide Area Network (WAN) interconnect devices (e.g. DTE, DCE, etc.). You should have a working knowledge of WANs, DTE and DCE devices, and BERT error statistics to use this application. This document assumes a basic knowledge of the DA-3x. Refer to the *DA-30/31 Operating Manual* for detailed operating instructions.

Requirements

The BERT Application runs on the DA-3x under Release 3.4. If you are currently running Core Software Version 3.3 or an earlier release on your DA-3x, you need to upgrade to Release 3.4.

There are five versions of the BERT Application—one for each of the supported line interfaces. These applications and their corresponding line interfaces are:

Application	Line Interface
BERT_X21	X.21 Line Interface
BERT_V24	V.24 Line Interface
BERT_V35	V.35 Line Interface
BERT_V36	V.36 Line Interface
BERT_T1	T1 Line Interface

Load and run the application that is appropriate for the WAN line interface under test.

Note:

Although this document describes the operation for all of the above-mentioned BERT applications, many of the screens, windows and menus that are used as examples correspond to those displayed by the BERT Application for the X.21 interface (BERT_X21). Any interface-specific differences in these screens, windows and menus are noted in the appropriate sections.

Before running the BERT Application, you need to have a High Speed WAN Feature Module and WAN Line Interface Module combination installed in slots 4 and 5 or slots 6 and 7 of your DA-3x. Also, the latest version of the High Speed WAN Line Interface Package—that corresponds with your interface—must be installed on your DA-3x's hard disk.

How This Manual Is Organized

This document is organized into the following chapters:

Chapter 1, Getting Started	introduces the BERT Application, describes what the application does and when it should be used. This chapter also provides instructions for connecting the DA-3x to the device under test and for loading and running BERT.
Chapter 2, BERT Basics	describes the components of the BERT Main menu, describes on-line help and the softkey rack, indicates where to find procedures for loading the application and using it to perform BERTs, and details the difference between the BERT Application's two operational modes.
Chapter 3, BERT Test Setup	describes how to set up the BERT line interface and transmitter options.
Chapter 4, Performing the BERT	provides information on performing the loopback (local and remote) and BERT. It also provides information on interpreting BERT statistics.

Revision History

The following is the revision history for the Bit Error Ratio Test (BERT) Application document.

First Edition	October 1993
Second Edition	November 1993

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Getting Started

This chapter introduces the Bit Error Ratio Test (BERT) Application and describes what the application does and when it should be used. It also provides instructions for connecting the DA-3x to the device under test (DTE or DCE) and for loading and running the BERT Application.

1.1. What Does the BERT Application Do?

The BERT Application enables the DA-3x to test the reliability of a digital transmission channel between a DTE and local or remote DCE. It also enables the DA-3x to check the functioning of local and remote DCEs.

BERT testing involves a transmitter and receiver that independently generate the same bit (test) pattern. The BERT Application enables the DA-3x to act as a BERT tester. Generally, a BERT tester generates a test pattern which is transmitted by its BERT transmitter to the device under test. The pattern is then looped back to its own BERT receiver on the channel that is under test. This allows for duplex (transmit and receive) line testing with only one BERT tester. The pattern can also be sent from the transmitter of one BERT tester, passed through the device under test, and received by a second BERT tester. This allows for simplex (transmit or receive) line testing.

When the DA-3x receives a test pattern, it compares the received pattern to the specified test pattern (generated in the receiver) to determine whether errors occurred.

1.2. Off-Line Only!

The BERT Application is an off-line test tool. In the BERT mode, only BERT statistics are valid. All other network/interface statistics that can be accessed via the softkey rack (e.g. Network Summary, Character Trace, etc.) are unreliable.

1.3. When Should You Use the BERT Application?

The error statistics and performance parameters provided by BERT can be used:

- to check the proper operation of a DCE (local or remote)
- as an acceptance criteria to test interconnection devices (e.g. repeaters) before installation on a live network
- to check the reliability of the transmission channels between a DTE and DCE as a restart test whenever an interconnection device is upgraded or expanded

Note:

A transmission channel consists of interface cables as well as any interconnecting devices inserted on the line.

1.4. What Hardware and Software Is Needed?

The BERT Application is a single analyzer application. To run the BERT Application, you must have a High Speed WAN Feature Module and a WAN Line Interface Module installed in the interface slots of your DA-3x. The High Speed WAN Feature Module and WAN Line Interface Module (V.24, V.35, V.36, X.21 or T1) must be installed in adjacent interface slots (slots 4 and 5 or slots 6 and 7). Moreover, you must have a Protocol Analyzer Module installed in slot 2 or 3.

Caution:

Do not attempt to run the BERT Application as a dual analyzer application. You risk the corruption of the BERT test pattern files.

The DA-3x Main Menu, as shown in Figure 1-1, reflects the instrument's architecture.

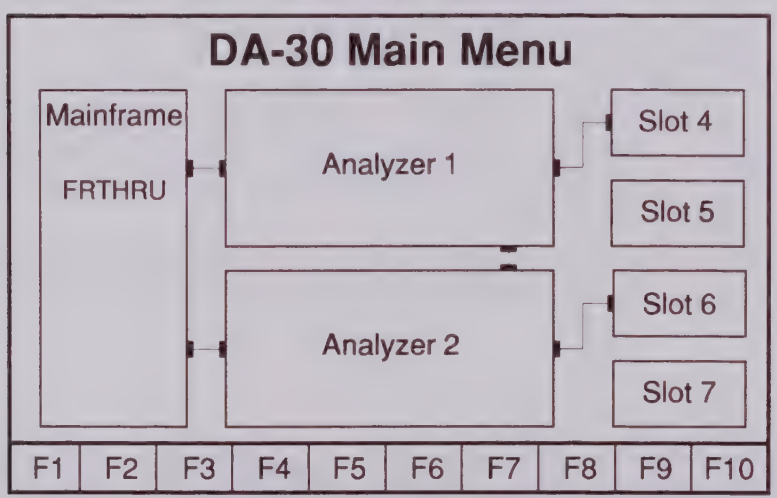


Figure 1-1 DA-3x Main Menu (reflecting the instrument's architecture)

Slot 2 or 3 contains the analyzer module. If the analyzer module is in slot 2 (Analyzer 1) then the High Speed WAN Feature Module and the WAN Line Interface should occupy slots 4 and 5. If the analyzer module is in slot 2 (Analyzer 2) then the High Speed WAN Feature Module and the WAN Line Interface should occupy slot 6 and 7.

You must also have the following software loaded on your DA-3x's hard disk.

- Release 3.4 (or later) Core Software
- High Speed WAN Line Interface Package

1.5. Connecting to the Device Under Test

A generic diagram of a Wide Area Network (WAN) is shown in Figure 1-2. The DA-3x can be configured to emulate the local DTE, the local DCE, the remote DTE or remote DCE in this diagram.

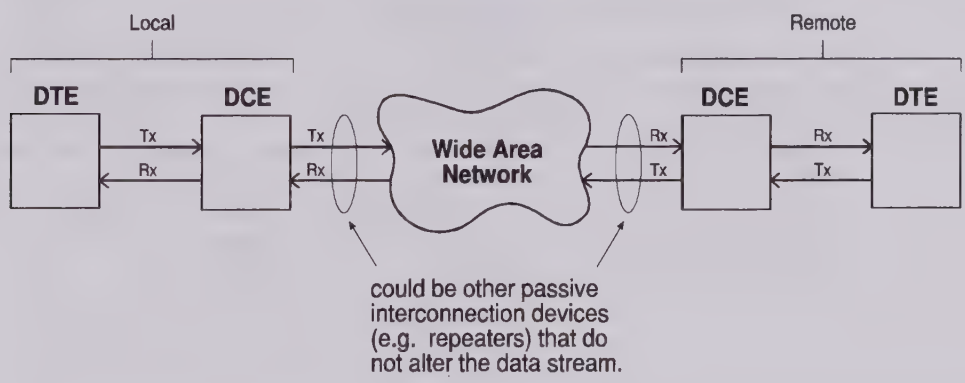


Figure 1-2 Generic WAN Diagram

The testing configurations basically fall into two categories: Loopback configurations and Thru (Non-loopback) configurations.

The Loopback configurations allow a single DA-3x to be used for BERT testing on both transmit and receive lines simultaneously. The BERT Application provides software initialization for local and remote loopback on the X.21 and V.24 Line Interfaces only. Loopback can be achieved on the other interfaces by using an additional loopback cable. In any case, before performing loopback, the DA-3x must be setup for DTE emulation.

Figure 1-3 shows a local loopback configuration that allows the DA-3x to test the functioning of the local DCE as well as the reliability of both the transmit and receive lines (duplex) at the local DTE-DCE interface.

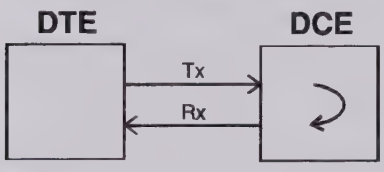


Figure 1-3 Local Loopback Configuration

Figure 1-4 shows a remote loopback configuration that allows the DA-3x to test the functioning of the remote DCE, the reliability of the transmit and receive lines at the local DTE-DCE interface as well as the WAN transmission path from the local DCE to the remote DCE and back.

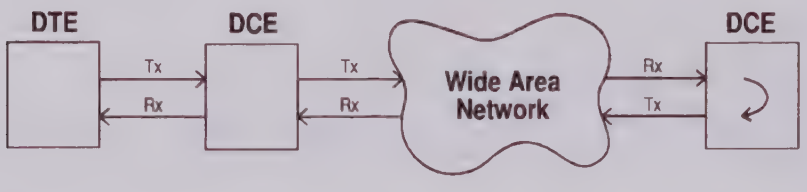


Figure 1-4 Remote Loopback Configuration

To perform loopback using an X.21 interface, you simply connect a DB15 cable between the DA-3x's DTE connector and the appropriate connector of the local DCE as shown in Figures 1-3 and 1-4. To perform loopback using the V.24 interface, however, requires the use of the auxiliary pins (AUX 1 and AUX 2) located on the rear panel of the V.24 Line Interface Module (LIM). This can be accomplished by building a special DB25 cable that breaks out pins 18 and 25 from the end that attaches to the DA-3x's DTE connector (Figure 1-5). Pin 18 should then be connected to AUX 1, and pin 25 should be connected to AUX 2. Connect the other end of the cable to the appropriate connector on the local DCE.

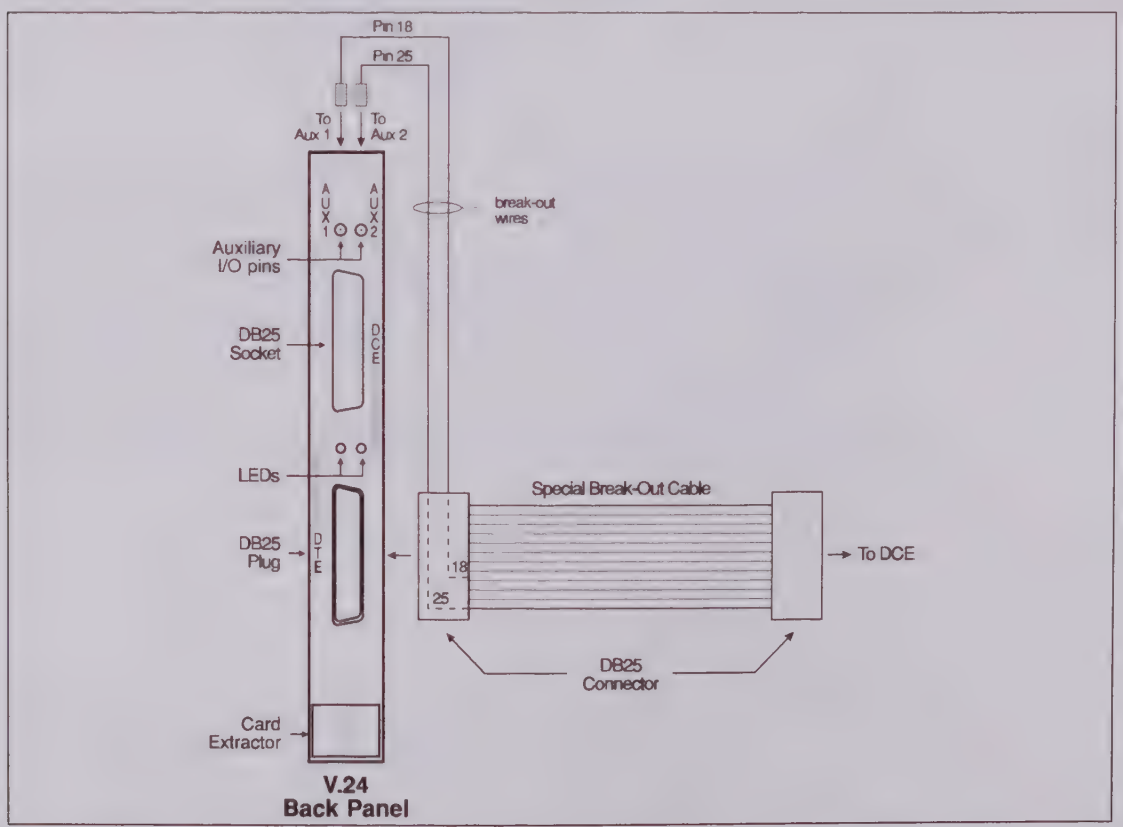


Figure 1-5 Special Break-Out Cable for V.24 Loopback

The Thru configurations limit you to simplex line testing (transmit or receive). Only some DCE functionality is tested. In the following Thru configurations, the DA-3x can be setup to emulate either the DTE or the DCE. Moreover, a second DA-3x (or another BERT tester—one setup for DTE emulation, the other setup for DCE emulation—could be used to test both the transmit and receive paths simultaneously. Of course, both testers must be in the BERT mode.

Note:

The terms "DTE" and "DCE" are used in the following discussion of the Thru configurations. However, if you are testing on a T1 network, the term "DTE" corresponds to a CPE (Customer Premises Equipment), and the term "DCE" corresponds to a CSU (Channel Service Unit) or some other network terminating device. When connecting your T1 interface, use only the CPE ports. They are labeled "TO NET" on the rear panel.

Figure 1-6 shows a configuration that allows the DA-3x to test the reliability of the receive line at the local DTE-DCE interface (if emulating a DTE) or the transmit line at the local DTE-DCE interface (if emulating a DCE).

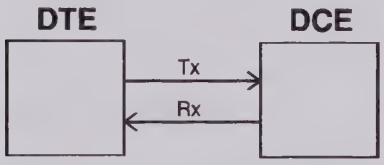


Figure 1-6 Thru Configuration 1

Figure 1-7 shows a configuration that allows the DA-3x to test the reliability of the receive line at the local DTE-DCE interface and the WAN transmission path from the remote DCE to the local DCE (if emulating a local DTE). This configuration also allows the DA-3x to test the reliability of the transmit line at the local DTE-DCE interface and the WAN transmission path from the local DCE to the remote DCE (if emulating a remote DCE).

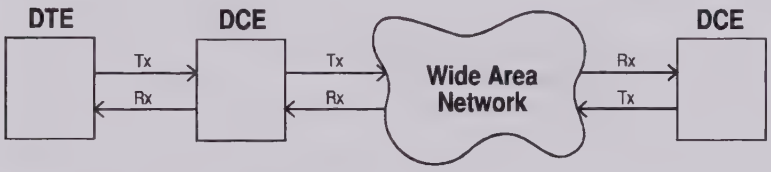


Figure 1-7 Thru Configuration 2

Figure 1-8 shows a configuration that allows the DA-3x to test the reliability of the transmit line at the remote DTE-DCE interface and the WAN transmission path from the remote DCE to the DA-3x (if emulating a local DCE). This configuration also allows the DA-3x to test the reliability of the receive line at the remote DTE-DCE interface and the WAN transmission path from the local DCE to the remote DCE (if emulating a remote DTE).

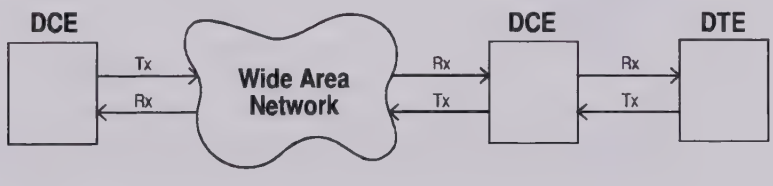


Figure 1-8 Thru Configuration 3

If you are testing on a T1 network, you have an additional connection possibility. The T1 interface can be connected, in series, between a CPE and a CSU. The incoming traffic (Tx or Rx line) is received on the "TO NET" IN connector, routed through the T1 interface, and sent back out on the "TO CPE" OUT connector. Once connected, the T1 interface should be configured in a "pass-through" mode by setting the Test Function field (on the T1 Line Setup menu) to RECEIVE ONLY. The "pass-through" mode does not allow error insertion.

Prior to running BERT, you need to connect the DA-3x to the device under test as shown in Figure 1-9.

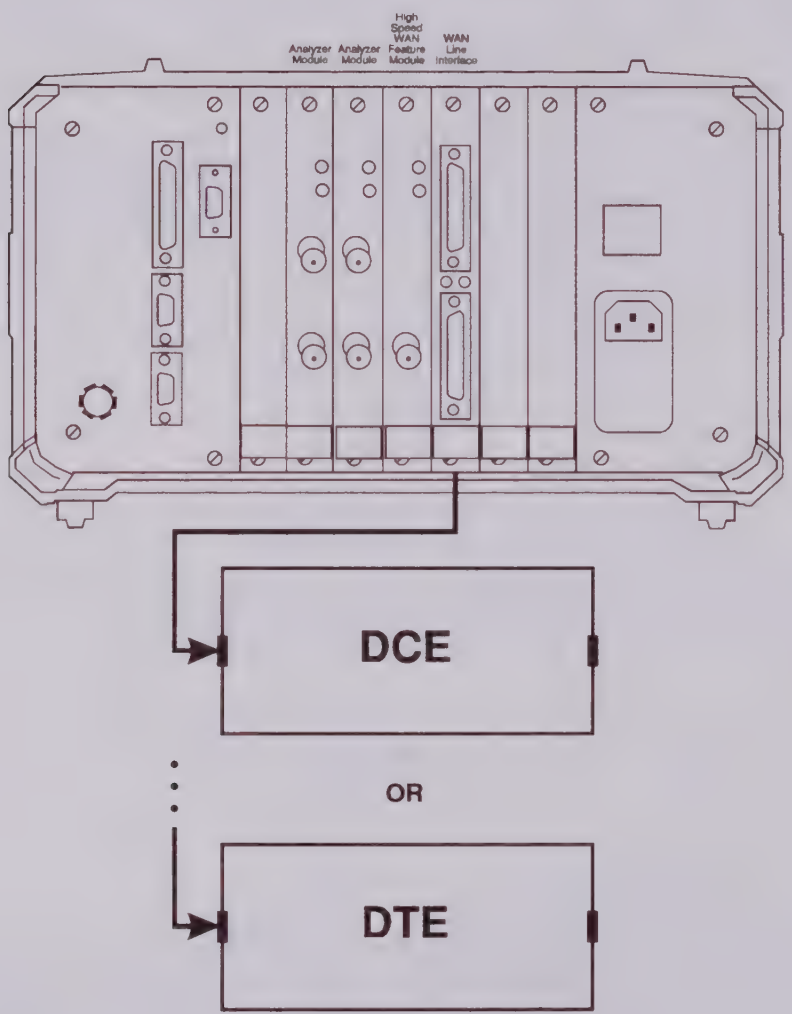


Figure 1-9 Connecting the DA-3x to the Device Under Test

For more detailed information on how to connect your particular interface, refer to the appropriate line interface section of the *DA-30/31 Line Interface Operation* binder.

Note:

All of the above Thru configuration are not typical test setups. However, they can be useful in laboratory settings when testing experimental networks, interconnecting devices, etc.

1.6. Loading and Running the BERT Application

In order to use the BERT Application, you need to load it into the DA-3x's memory and then go to Run mode. To load and run BERT, follow these steps:

1. From the DA-3x Main Menu, position the cursor on the Current Application field of the Mainframe window. Then press F1 (view options) to access the Application Management menu.
2. Using the Up Arrow or Down Arrow, position the cursor on the Application Group that leads to the BERT Application and press Enter. The list of available applications and subgroups appears. Continue searching through the subgroups of the tree structured directory until you reach the group containing the BERT Application.
3. Using the Up Arrow or Down Arrow, position the cursor on the BERT Application. Press Enter to load and run the application or press F1 (LOAD AS IS) to load the application and return to the DA-3x Main Menu.

From the DA-3x Main Menu, if the BERT Application has already been loaded, you can run BERT by simply pressing Alt-Run.

1.7. Modifying the Line Setup

BERT requires the line setup to be compatible with your network for the application to run. Refer to the appropriate line interface section of the *DA-30/31 Line Interfaces Operation* binder for information on modifying the line setup for the interface you are using.

1.8. What Should You Do If You Get Lost?

If you get lost or unable to return to a particular screen when you first start using the BERT Application, the information in Table 1-1 may be helpful.

If you are viewing...	**And you want to...**	**Then...**
The BERT Statistics screen or any BERT menu	Return to the BERT Main menu	Press Esc until the BERT Main menu appears
Any BERT screen or menu	Return to the DA-3x Main menu	Press Alt-menu (or Ctrl-M)
The BERT Main menu	Display on-line help information	Select Help from the BERT Main menu
Any DA-3x Run Mode screen	Return to BERT Main menu	Press F12 to display the top level softkey rack. Then press F10 (MORE) and F1 (APPL SCREEN)

Table 1-1 Menu Navigation Summary

1.9. Exiting the Application

You may want to exit BERT occasionally and return to the DA-3x's Main Menu, for example, if you have finished transmitting BERT test patterns and want to run another DA-3x application. You must return to the DA-3x's Main Menu before loading a different application. The Exit-MENU option on the Exit pull-down menu allows you to return to the DA-3x's Main Menu. Simply follow these steps:

1. Select Exit-MENU from the Exit pull-down menu.
2. The DA-3x exits BERT and returns to Menu mode.

However, to quickly return to the DA-3x's Main Menu, you could also press Alt-Menu (or Ctrl-M).

1.10. Where to Go for More Information

Refer to the remaining chapters of this manual for detailed information about the application. If you would like more information about loading and running applications, refer to Chapter 4, "Applications" of the *DA-30/31 Operating Manual*.

For more information on BERT statistics and performance parameters, see *CCITT Recommendation G.821*.

2

BERT Basics

This chapter describes the components of the BERT Main menu and details the difference between BERT's two operational modes.

2.1. The BERT Main Menu

When you run the BERT Application, the BERT Main menu appears, as shown in Figure 2-1.

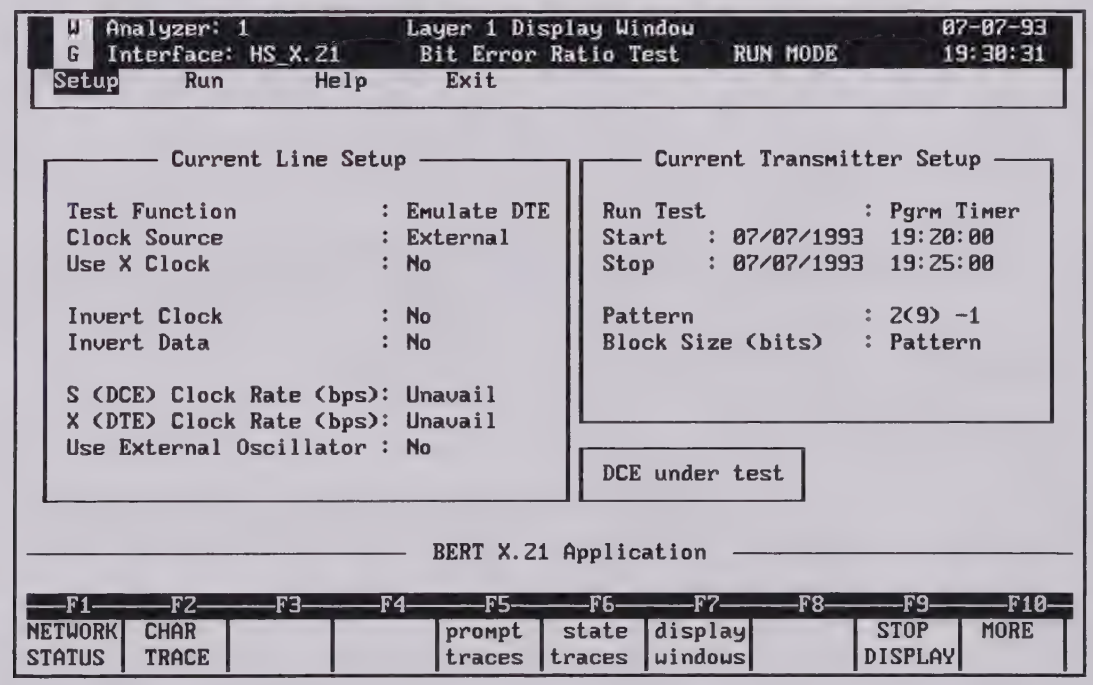


Figure 2-1 BERT Main Menu

The components of the BERT Main menu include:

- menu bar
- current line setup window
- current transmitter setup window
- device under test window
- prompt line
- Run mode softkey rack

These components are described in the following sections.

2.1.1. Menu Bar

The menu bar is located at the top of the screen. It contains the keywords for the application's pull-down menus as shown in Table 2-1:

Menu Item	Provides options for...
Setup	configuring the line interface and BERT transmitter. Setting the period for automatic printing of the statistics screen. Enabling the loopback verification and automatic loop delay calculation.
Run	selecting a loopback initialization (local or remote) to be performed on the device under test before BERT execution or for executing BERT directly. Loopback is available for the X.21 and V.24 interfaces only.
Help	displaying helpful information about BERT including keyboard and version number information
Exit	exiting BERT Application and returning to DA-3x's Main Menu

Table 2-1 Menu Bar Items

Use the Right Arrow or Left Arrow key to move among the menu bar items. To display the pull-down menu for a menu item, position the cursor on the keyword (such as Setup) and press Enter. On the pull-down menu, you can use the Up/Down Arrow keys to position the cursor on a desired item and press Enter to select it.

2.1.2. Current Line Setup

The BERT Current Line Setup window appears when you run the application. BERT displays this window whenever you are at the BERT Main menu. This window summarizes the current settings for the line interface.

The setup fields shown are a subset of the line settings available from the Line Setup menu accessed via the interface slot window (DA-3x Main Menu). The settings for these fields, at the time the BERT Application is run, are used as the application's default settings. These settings can, of course, be modified within the BERT Application via the Line option on the Setup pull-down menu. However, when you exit the BERT Application, the original line settings are not altered.

Because the setup fields actually displayed in the Current Line Setup window vary depending on the interface that you have installed, a discussion of these fields has been reserved for Section 3.2.1, "Line Setup." Refer to the sub-section that corresponds to your interface (e.g. Section 3.2.1.1, "X.21 Line Setup" for the X.21 interface).

2.1.2.1. V.24, V.35, V.36 and X.21

The Current Line Setup window for the V.24, V.35, V.36 and X.21 interfaces resembles the one shown in Figure 2-2.

```
Current Line Setup

Test Function              : Emulate DTE
Clock Source               : External
Use X Clock                : No

Invert Clock               : No
Invert Data                : No

S (DCE) Clock Rate (bps): Unavail
X (DTE) Clock Rate (bps): Unavail
Use External Oscillator : No
```

Figure 2-2 Current Line Setup Window for X.21

The DA-3x automatically checks the clock lines for the presence of clock signals when you run the BERT Application. During this process, the text string "Determining line-speed..." is displayed at the bottom of the screen.

If a clock is present, its frequency is calculated and displayed in the clock rate fields. In addition, the text string "Line-speed detection done" is displayed at the bottom of the screen. Whenever an expected external clock signal is not detected, the "Unavail" text string is displayed instead.

2.1.2.2. T1

The Current Line Setup window for the T1 interface looks like the one shown in Figure 2-3.

```
Current Line Setup

Test Function              : TX ORIG CPE

                      net          cpe
Framing          : ESF          ESF
Line Code        : AMI          AMI
Channel Type     : 64 kbps      64 kbps


Bert    -   2   -   -   -   -   7   8
on      -   -   -   -   -   -   -   -
Chan    -   -   -   -   -   -   -   -
```

Figure 2-3 Current Line Setup Window for T1

This window reports the framing format, the line code, and the channel type for both sides of the interface (CPE and NET). It also provides a summary of the channels that are currently being used for BERT.

2.1.3. Current Transmitter Setup

The BERT Current Transmitter Setup window (Figure 2-4) appears when you run the application. BERT displays this window whenever you are at the BERT Main menu.

```
Current Transmitter Setup

Run Test                   : Pgrm Timer
Start    : 07/07/1993  19:20:00
Stop     : 07/07/1993  19:25:00

Pattern                    : 2(9) -1
Block Size (bits)          : Pattern
```

Figure 2-4 Current Transmitter Setup Window

This window summarizes the current settings of the BERT transmitter. These settings can be modified via the Transmitter option on the Setup pull-down menu.

Table 2-2 describes the fields shown on the Current Transmitter Setup Window.

Current Transmitter Setup Field	**Displays...**
Run Test	one of the following text strings: "Continuous" when the BERT timer is in the Continuous mode "Stop Timer" when the BERT timer is in the Programmed Stop mode "Pgrm Timer" when the BERT timer is in the Programmed Start/Stop mode The modes of the BERT timer are discussed in Section 3.2.2.1, "Time Setting."
Duration	the test duration. This field appears only when the BERT timer is in the Programmed Stop mode. The date is shown in the mm/dd/yyyy format followed by the duration in the hh:mm:ss format. See Section 3.2.2.1, "Time Setting."
Start	the start time of the test. This field appears only when the BERT timer is in the Programmed Start/Stop mode. The date is shown in the mm/dd/yyyy format followed by the start time in the hh:mm:ss format. See Section 3.2.2.1, "Time Setting."
Stop	the stop time of the test. This field appears only when the BERT timer is in the Programmed Start/Stop mode. The date is shown in the mm/dd/yyyy format followed by the stop time in the hh:mm:ss format. See Section 3.2.2.1, "Time Setting."
Pattern	the selected test pattern expressed as a polynomial. See Section 3.2.2.2, "Patterns."
Block Size (bits)	the text string "Pattern" which indicates that the block size is the same as the pattern size. See Section 4.4, "BERT."

Table 2-2 Transmitter Setup Window Fields

2.1.4. Device Under Test

The Device Under Test status field underneath the Current Transmitter Setup window. This field reports the type of device that is being tested as shown in Table 2-3.

Test Status Message	Displayed when...
DCE under test	emulating a DTE. The Test Function is set to Emulate DTE on the Line Setup menu.
DTE under test	emulating a DCE. The Test Function is set to Emulate DCE on the Line Setup menu.
Mon under test	**X.21, V.24, V.35 and V.36 BERT Applications:** the Test Function—upon running the BERT Application—is set to Monitor on the Line Setup menu (accessed via the DA-3x Main Menu's interface slot window). However, because Monitor is not a valid Test Function setting for BERT, you are not allowed to perform a BERT until you change the Test Function to one of the emulation settings (e.g. Emulate DTE). **T1 BERT Application:** the Test Function—upon running the BERT Application—is set to RECEIVE ONLY on the Line Setup menu.
CPE under test	emulating a T1 network. The Test Function is set to TX ORIG NET or TX D&I NET on the Line Setup menu. For T1 only.
NET under test	emulating Customer Premises Equipment (CPE). The Test Function is set to TX ORIG CPE or TX D&I CPE on the Line Setup menu. For T1 only.

Table 2-3 Device Under Test Status

2.1.5. Prompt Line

The prompt line, displayed at the bottom of the screen provides information about key usage and explanations about current selections.

2.1.6. Online Help

Online help is provided for the BERT Application. A scrollable help screen is associated with each pull-down menu listed on the BERT Main menu bar. You can access these screens in one of two ways.

First, you can select the menu name and press the Help key. The same help screen is displayed whether you highlight only the menu's name or one of its options before pressing Enter.

Second, you can use the Help pull-down menu. The Help pull-down menu presents the choices listed in Table 2-4.

Help Option	Provides...
Getting Started	a brief description of the application. You can also access this screen by either highlighting the Help menu and pressing the Help key or by pressing the H (Help) key from any of the other help screens.
Keyboard	a list of the special keys and what they mean when used in the BERT Application.
About	general information about the application software such as the name, brief description, version number and copyright.

Table 2-4 On-line Help Options

2.1.7. Run Mode Softkey Rack

The Run Mode softkey rack, located at the bottom of the screen, consists of 10 softkeys labeled F1 to F10. These softkeys enable you to view various DA-3x displays and to change modes. The valid Run Mode softkeys for BERT and their associated functions are summarized in Table 2-5.

Softkey	Function
F1	Displays the Network Status screen.
F2	Displays the Character Trace screen.
F3	Displays the Protocol Trace softkey rack for the loaded protocols.
F5	Displays the Prompt Trace softkey rack. The Layer 1 prompt trace (F1) contains messages that are useful for tracking the activity of the BERT Application whenever you are uncertain of how the application is executing or you are trying to troubleshoot an abnormal condition.
F7	Displays the Display Window softkey rack. The Layer 1 Display Window contains the BERT Application screens.
F8	Switches between displaying the Run Mode and Exam Mode display screens for one analyzer or both analyzers simultaneously.
F9	Freezes the Run Mode display.
F10	The More key displays a second softkey rack that contains the following four softkeys: F1 changes to the current application's display window F2 switches to Exam Mode F3 switches to Menu Mode F4 goes to the currently defined DOS application

Table 2-5 Run Mode Softkeys and Their Functions

2.2. Procedure

To use BERT to test a DCE (local or remote) or a transmission channel, you need to perform the procedures listed below. Table 2-6 provides a reference for each procedure indicating where in this document you can find additional procedural information.

To do this...	Refer to...
Connect the DA-3x to the device to be tested	Section 1.5., "Connecting to the Device Under Test"
Load BERT	Section 1.6., "Loading and Running the BERT Application"
Run the application by pressing Alt-Run	Section 1.6., "Loading and Running the BERT Application"
Edit the WAN line interface or BERT transmitter setup and enable/disable loopback verification	Chapter 3, "BERT Test Setup"
Perform the BERT calculations	Chapter 4, "Performing the BERT"
View the results	Chapter 4, "Performing the BERT"

Table 2-6 Procedure for Testing with BERT

2.3. Setup Mode vs. Run Mode

BERT has two operational modes:

Setup mode — for configuring the line interface and BERT transmitter, enabling loopback verification and automatic loop delay adjustment, and setting the period for automatic printing of the statistics screen.

Run mode — for transmitting bit patterns, comparing received patterns, and calculating G.821 statistics.

When you load and run BERT, the application automatically places you in Setup mode. After completing the line and transmitter setup, you can go to Run mode by selecting one of the loopback options or the BERT option from the Run pull-down menu.

While the BERT test is being performed, BERT statistics are displayed on the application screen. Pressing Backspace always returns you to the application display window. If you are performing the BERT and want to return to the Current Setup screen, press Esc to stop the test and go to Setup mode.

BERT Test Setup

This chapter describes how to set up the WAN line interface and the BERT transmitter. It also describes how to enable/disable the loopback verification option as well as how to set the print interval for the automatic printing of the BERT statistics screen.

3.1. Overview of BERT Test Setup

Before performing the BERT, you need to make any necessary changes to the line and transmitter setup options. The options on the Setup pull-down menu allow you to set the emulation type, line speed; specify the clock source; select a BERT test pattern; and specify the test duration. This chapter provides information on these and other setup tasks.

You can run BERT using the default settings for all of these options or you can modify any or all of the values.

3.2. Setup

Figure 3-1 shows a sample Setup pull-down menu for the X.21 line interface. The options listed on the Setup menu depend on the WAN line interface that you have installed.

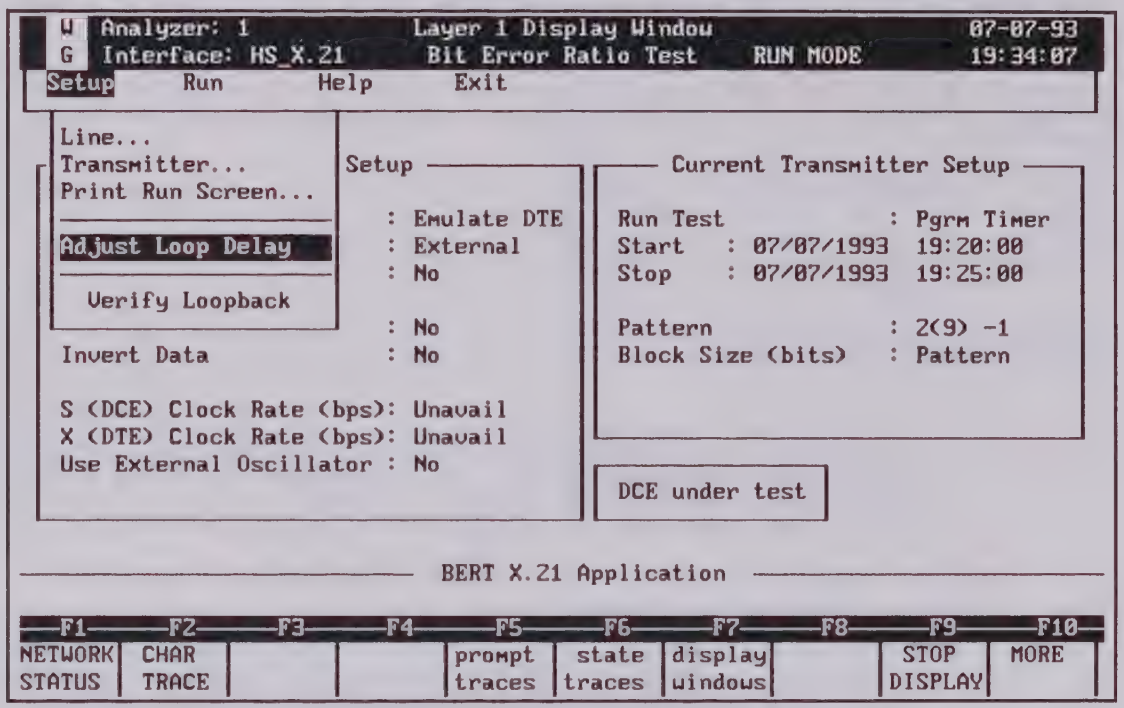


Figure 3-1 Setup Pull-down Menu

From the Setup pull-down menu, you can modify the following:

- Line Setup
- Transmitter Setup
- Print Run Screen
- Adjust Loop Delay (for X.21 only)
- Verify Loopback (for X.21 only)

To modify these parameters, highlight the appropriate selection and press Enter. Make the desired modifications and press Enter to return to the Setup pull-down menu. After making your changes, you can return to the BERT Main menu, from the Setup pull-down menu, by pressing Esc. The following sections provide information on the setup parameters.

3.2.1. Line Setup

The possible line setup options for the various line interfaces are shown and discussed in the following sections. The actual fields listed in the line setup window depend on the WAN line interface that you have installed. In any case, all fields shown are either toggle or data entry fields. For more detailed information on the fields for the various line interfaces, refer to the appropriate line interface section of the *DA-30/31 Line Interface Operation* binder.

3.2.1.1. X.21 Line Setup

Figure 3-2 shows the X.21 Line Setup Window and its default field settings.

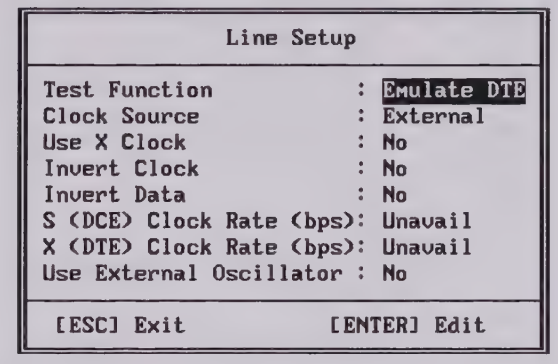

Line Setup
Test Function : Emulate DTE
Clock Source : External
Use X Clock : No
Invert Clock : No
Invert Data : No
S (DCE) Clock Rate (bps): Unavail
X (DTE) Clock Rate (bps): Unavail
Use External Oscillator : No
[ESC] Exit
[ENTER] Edit

Figure 3-2 X.21 Line Setup Window

The X.21 line setup options are listed in Table 3-1.

X.21 Line Setup Field	To modify...
Test Function	Toggle between Emulate DTE and Emulate DCE. Whenever this field is changed, the line speed is automatically re-determined before running BERT. Defaults to Emulate DTE.
Clock Source	Toggle between Internal and External. Whenever this field is changed, the line speed is automatically re-determined before running BERT. Defaults to External.
Use X Clock	Toggle between Yes and No. Defaults to No.
Invert Clock	Toggle between Yes and No. Defaults to No.
Invert Data	Toggle between Yes and No. Defaults to No.
S (DCE) Clock Rate (bps)	Defaults to the line speed of the WAN to which the DA-3x is connected when the clock source is external. When the clock source is internal, select from a table of standard clock rates (Figure 3-3). This field is related to the X (DTE) Clock Rate field. Thus, your selection here determines the rate of the X Clock and vice versa.
X (DTE) Clock Rate (bps)	Defaults to the line speed of the WAN to which the DA-3x is connected when the clock source is external. When the clock source is internal, select from a table of standard clock rates (Figure 3-3). This field is related to the S (DCE) Clock Rate field. Thus, your selection here determines the rate of the S Clock and vice versa.
Use External Oscillator	Toggle between Yes and No. Defaults to No.

Table 3-1 X.21 Line Interface Setup Fields

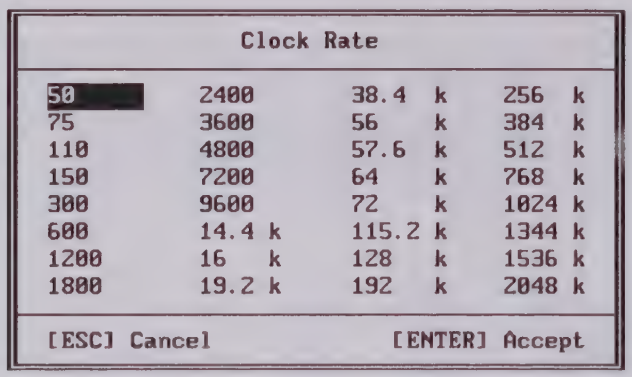


Figure 3-3 Clock Rate Selection Window

Kilobits per second is the unit used for those rates marked with a "k." For the others, the associated unit is bits per second.

3.2.1.2. V.24 & V.35 Line Setup

Figure 3-4 shows the V.24 and V.35 Line Setup Window and its default field settings.

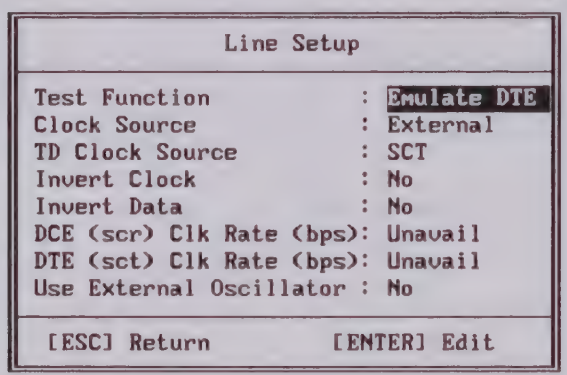

Line Setup
Test Function : Emulate DTE
Clock Source : External
TD Clock Source : SCT
Invert Clock : No
Invert Data : No
DCE (scr) Clk Rate (bps): Unavail
DTE (sct) Clk Rate (bps): Unavail
Use External Oscillator : No
[ESC] Return
[ENTER] Edit

Figure 3-4 V.24 and V.35 Line Setup Window

The V.24 and V.35 line setup options are listed in Table 3-2.

V.24/V.35 Line Setup Field	To modify...
Test Function	Toggle between Emulate DTE and Emulate DCE. Whenever this field is changed, the line speed is automatically re-determined before running BERT. Defaults to Emulate DTE.
Clock Source	Toggle between Internal and External. Whenever this field is changed, the line speed is automatically re-determined before running BERT. Defaults to External.
TD Clock Source	Toggle between SCT and SCTE. Defaults to SCT.
Invert Clock	Toggle between Yes and No. Defaults to No.
Invert Data	Toggle between Yes and No. Defaults to No.
DCE (scr) Clk Rate (bps)	Defaults to the line speed of the WAN to which the DA-3x is connected when the clock source is external. When the clock source is internal, select from a table of standard clock rates (Figure 3-3). This field is related to the DTE (sct) Clock Rate field. Thus, your selection here determines the rate of the DTE Clock and vice versa.
DTE (sct) Clk Rate (bps)	Defaults to the line speed of the WAN to which the DA-3x is connected when the clock source is external. When the clock source is internal, select from a table of standard clock rates (Figure 3-3). This field is related to the DCE (scr) Clock Rate field. Thus, your selection here determines the rate of the DCE Clock and vice versa.
Use External Oscillator	Toggle between Yes and No. Defaults to No.

Table 3-2 V.24 & V.35 Line Interface Setup Fields

Caution:

Operating the V.24 line interface at clock rates greater than 19.2 k is not recommended. Although higher clock rates are possible, the BERT_V24 application may give you unpredictable and unreliable results.

3.2.1.3. V.36 Line Setup

Figure 3-5 shows the V.36 Line Setup Window and its default field settings.

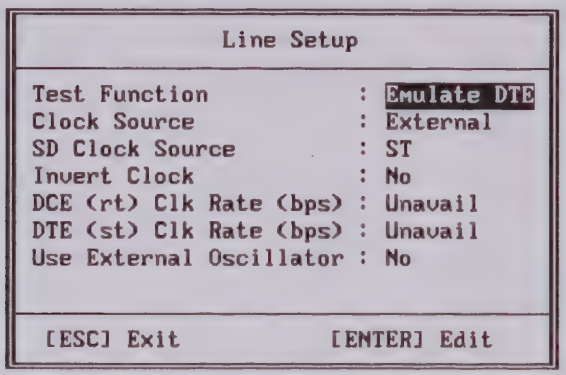

Line Setup
Test Function : Emulate DTE
Clock Source : External
SD Clock Source : ST
Invert Clock : No
DCE (rt) Clk Rate (bps) : Unavail
DTE (st) Clk Rate (bps) : Unavail
Use External Oscillator : No
[ESC] Exit
[ENTER] Edit

Figure 3-5 V.36 Line Setup Window

The V.36 line setup options are listed in Table 3-3.

V.36 Line Setup Field	To modify...
Test Function	Toggle between Emulate DTE and Emulate DCE. Whenever this field is changed, the line speed is automatically re-determined before running BERT. Defaults to Emulate DTE.
Clock Source	Toggle between Internal and External. Whenever this field is changed, the line speed is automatically re-determined before running BERT. Defaults to External.
SD Clock Source	Choose either ST, TT and RT. Defaults to ST.
Invert Clock	Toggle between Yes and No. Defaults to No.
Invert Data	Toggle between Yes and No. Defaults to No.
DCE (scr) Clk Rate (bps)	Defaults to the line speed of the WAN to which the DA-3x is connected when the clock source is external. When the clock source is internal, select from a table of standard clock rates (Figure 3-3). This field is related to the DTE (sct) Clk Rate field. Thus, your selection here determines the rate of the DTE Clock and vice versa.
DTE (sct) Clk Rate (bps)	Defaults to the line speed of the WAN to which the DA-3x is connected when the clock source is external. When the clock source is internal, select from a table of standard clock rates (Figure 3-3). This field is related to the DCE (scr) Clk Rate field. Thus, your selection here determines the rate of the DCE Clock and vice versa.
Use External Oscillator	Toggle between Yes and No. Defaults to No.

Table 3-3 V.36 Line Interface Setup Fields

3.2.1.4. T1 Line Setup

Figure 3-6 shows the T1 Line Setup Window and its default field settings.

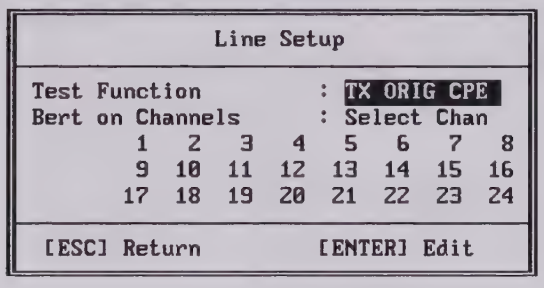

Line Setup
Test Function : TX ORIG CPE
Bert on Channels : Select Chan
1 2 3 4 5 6 7 8
9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24
[ESC] Return [ENTER] Edit

Figure 3-6 T1 Line Setup Window

The T1 line setup options are listed in Table 3-4.

T1 Line Setup Field	To modify...
Test Function	This is an auto-selecting field. Upon running the BERT Application, this field defaults to the Test Function setting on the Line Setup menu (accessed via the DA-3x Main Menu's interface slot window). The following message is displayed as a reminder at the bottom of the screen if you try to make a Test Function selection: "TEST FUNCTION may only be changed from LINE INTERFACE SETUP menu." The valid settings are: TX ORIG CPE, TX D&I CPE, and RECEIVE ONLY. The BERT Application does not support the TX ORIG NET and TX D&I NET settings.
Bert on Channels	Select from a list of 24 channels. Figure 3-7 shows the available channels. Defaults to all channels being selected.

Table 3-4 T1 Line Interface Setup Fields

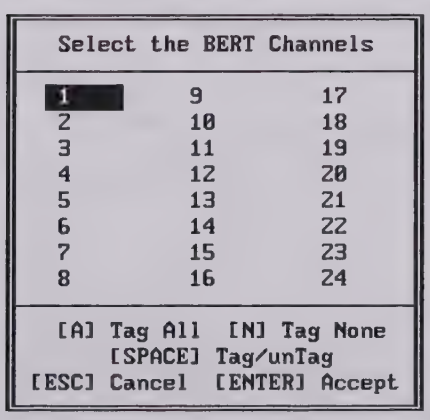


Figure 3-7 BERT Channels Selection Box

Pressing the Spacebar on a highlighted channel selection tags/untags it. Once a channel has been tagged, an asterisk is displayed next to the channel number on the Select the BERT Channels list and the channel number is simultaneously displayed in the appropriate channel position on the Line Setup window. To tag all the channels at once, press A. To untag all the channels at once, press N.

3.2.2. Transmitter Setup

Figure 3-8 shows the Transmitter Setup window. This window allows the user to set the start time and test duration using the Time Setting option and select a test pattern using the Patterns option.

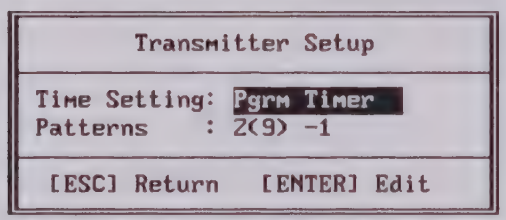


Figure 3-8 Transmitter Setup Window

3.2.2.1. Time Setting

This field allows you to program the BERT timer. The BERT timer has three modes of operation: continuous, programmed stop and programmed start/stop. Select the Time Setting field, and press Enter. The Time Setting window appears, as shown in Figure 3-9, presenting you with the three choices.

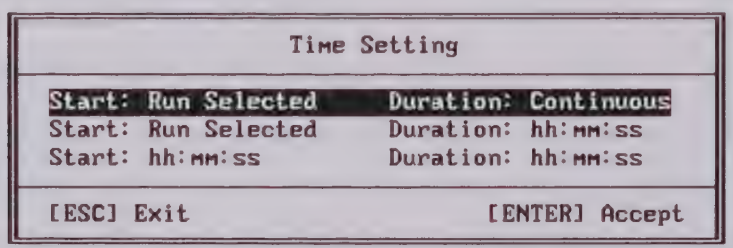

Time Setting
Start: Run Selected Duration: Continuous
Start: Run Selected Duration: hh:mm:ss
Start: hh:mm:ss Duration: hh:mm:ss
[ESC] Exit [ENTER] Accept

Figure 3-9 Time Setting Window

Note:

All time entries are based on the 24-hour clock. The BERT timer does not provide for setting the date. Consequently, time settings always refer to the current date.

Follow the steps listed for one of the following three modes to set the start time and/or duration.

Continuous Mode:

You want the BERT to start as soon as the DA-3x enters the BERT Run mode and to run continuously.

1. Position the cursor on the **Start: Run Selected Duration: Continuous** selection.
2. Press Enter to return to the Transmitter Setup window. The Time Setting field displays "Continuous."

Programmed Stop Mode:

You want the BERT to start as soon as the DA-3x enters the BERT Run mode and to stop running after a certain period of time. The BERT Application beeps twice at the completion of the BERT.

1. Position the cursor on the **Start: Run Selected Duration: hh:mm:ss** selection.
2. Press Enter to display a Clock Time Setting dialog box that prompts you for the test duration (Figure 3-10).

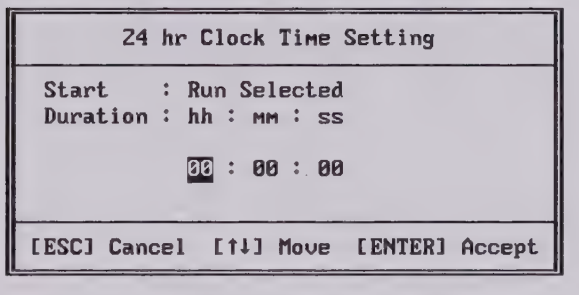


Figure 3-10 Dialog Box for the "Start: Run Selected Duration: hh:mm:ss" Option

3. The test duration is entered in the hh:mm:ss format. Using the Up/Down Arrow keys, position the cursor on the desired Duration time field: hh (hours), mm (minutes) or ss (seconds). The Down Arrow key moves the cursor one field to the right while the Up Arrow key moves the cursor one field to the left.
4. Enter a value for the selected field. After entering the desired test duration, press Enter to return to the Transmitter Setup window. The Time Setting field displays "Stop Timer."

   If you decide that you do not want to change the time setting, press Esc. You return to the Transmitter Setup window without making any changes.

Programmed Start/Stop Mode:

You want the BERT to start at a certain time after the DA-3x enters the BERT Run mode and to stop running after a certain period of time. The BERT Application beeps twice at the completion of the BERT.

1. Position the cursor on the **Start: hh:mm:ss Stop: hh:mm:ss** selection.
2. Press Enter to display a Clock Time Setting dialog box that prompts you for the start time and test duration (Figure 3-11).

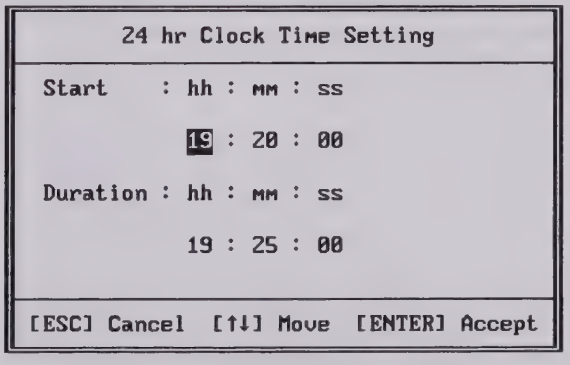


Figure 3-11 Dialog Box for the "Start: hh:mm:ss Stop: hh:mm:ss" Option

3. The start time is entered in the hh:mm:ss format. Using the Up/Down Arrow keys, position the cursor on the desired Start time field: hh (hours), mm (minutes) or ss (seconds). The Down Arrow key moves the cursor one field to the right while the Up Arrow key moves the cursor one field to the left.

4. Enter a value for the selected field. After entering the desired start time, either press Enter to return to the Transmitter Setup window or go on to set the test duration (Step 5). Pressing the Down Arrow key, while the ss field is selected, moves the cursor to the first Duration time field (hh).

5. The test duration is entered in the hh:mm:ss format. Using the Up/Down Arrow keys, position the cursor on the desired Duration time field: hh (hours), mm (minutes) or ss (seconds). The Down Arrow key moves the cursor one field to the right while the Up Arrow key moves the cursor one field to the left. Pressing the Up Arrow key, while the hh field is selected, moves the cursor to the last Start time field (ss).

6. Enter a value for the selected field. After entering the desired test duration, press Enter to return to the Transmitter Setup window. The Time Setting field displays "Pgrm Timer" to indicate that the BERT is under programmed control.

Note:

When editing a time field that has been cleared (contains 00), the first digit you type replaces the digit in the left position. Any subsequent digit you type replaces the digit in the right position.

When editing a time field that already contains a value, the digit you type replaces the digit in right position only. In order to modify the digit in the left position, you must, first, clear both digit positions by using the Backspace key and then type the desired two-digit number. Again, the first digit you type replaces the digit in the left position. Any subsequent digit you type replaces the digit in the right position.

If you decide that you do not want to change the time setting, press Esc. You return to the Transmitter Setup window without making any changes.

Upon entering the BERT Run mode, the application displays an alert message (Figure 3-12) indicating that the BERT timer has been programmed to start at a specified time.

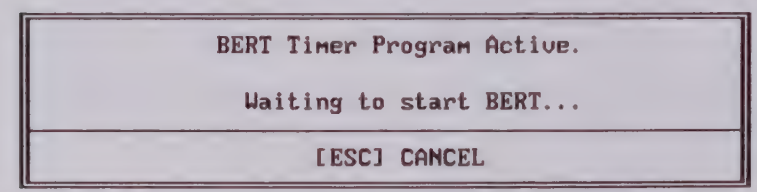


Figure 3-12 Programmed Start Alert Message

3.2.2.2. Patterns

This field displays the specific test pattern being used.

To select a BERT test pattern, follow these steps:

1. Select the Patterns field, and press Enter. The pattern selection window shown in Figure 3-13 appears.

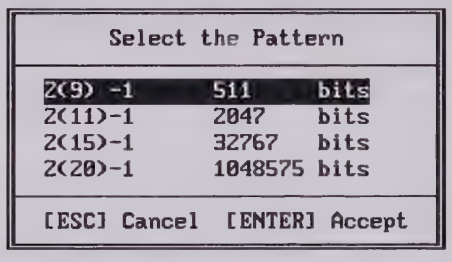


Figure 3-13 Pattern Selection Window

The pattern selection window lists the supported patterns and their corresponding bit lengths. Each pattern is given in the form of a polynomial as follows:

2(n) - 1 where n is the exponent of 2.

2. Using the Up/Down Arrow keys, position the cursor on the desired pattern. Press Enter to select it and return to the Transmitter Setup window. The Patterns field displays the pattern's polynomial.

   If you decide that you do not want to change the test pattern, press Esc. You return to the Transmitter Setup window without making any changes.

3.2.3. Print Run Screen

Figure 3-14 shows the Print Screen Period selection window. This window allows you to set the enable/disable automatic printing of the BERT Statistics screen. It also allows you to select the print period (time interval between screen prints).

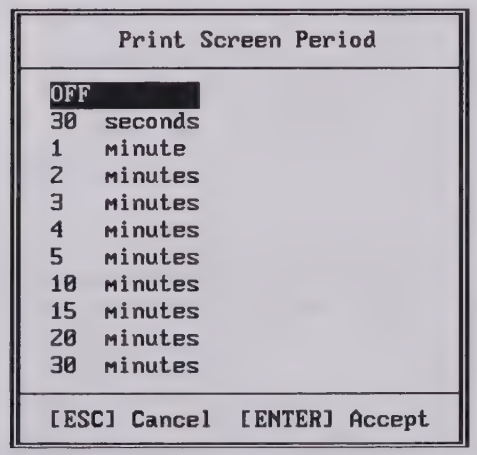


Figure 3-14 Print Screen Period Selection Window

To enable automatic printing, follow these steps:

1. Using the Up/Down Arrow keys, position the cursor on the desired print interval.
2. Press Enter to select the print period and return to the Setup pull-down menu.

To disable automatic printing, follow these steps:

1. Using the Up Arrow key, position the cursor on the OFF selection.
2. Press Enter to disable automatic printing and return to the Setup pull-down menu.

If you decide that you do not want to change the print period or the enable/disable status of automatic printing, press Esc. You return to the Setup pull-down menu without making any changes.

3.2.4. Adjust Loop Delay (for X.21 only)

Loop delay adjustment is meaningful only in cases where one of the loopback test configurations is being used and Verify Loopback is enabled. The Verify Loopback toggle is discussed in Section 3.2.5, "Verify Loopback."

When performing a loopback BERT, the DA-3x sends loopback initialization commands to the DCE (local or remote). In order to verify that the DCE is in the loopback mode before running BERT, the DA-3x searches for a loopback confirmation. This confirmation is the reception of the initialization test frame that was transmitted to the DCE.

The amount of time that the DA-3x waits for the return of the initialization test frame is known as the loop delay. A time-out occurs when the DA-3x does not receive the test initialization frame within the loop delay period. If this happens, the loop delay can be adjusted until an appropriate delay is achieved. The BERT Application allows for both manual and automatic loop delay adjustment. This section describes manual adjustment. Automatic loop delay adjustment is described later in Chapter 4 (Section 4.2, "Local LoopBack").

Figure 3-15 shows the Manual Loop Delay Adjustment window.

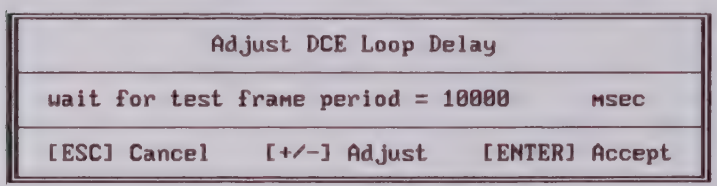


Figure 3-15 Manual Loop Delay Adjustment Window

The value that follows the "wait for test frame period =" string represents the current loop delay time-out value.

The default time-out value is 10,000 milliseconds. However, different modems (DCEs) will have different loop delays associated with them due to different line speeds, inherent device delays, etc. If you know what delay to expect, then you can manually adjust the loop delay in this window.

To manually adjust the loop delay time-out value, follow these steps:

1. Using the +/- keys, increment/decrement the loop delay time-out value in 50 millisecond steps. The maximum value for the loop delay time-out is 30,000 milliseconds. The minimum value is 500 milliseconds.
2. Press Enter to set the new loop delay value and return to the Setup pull-down menu.

   If you decide that you do not want to change the loop delay value, press Esc. You return to the Setup pull-down menu without making any changes.

3.2.5. Verify Loopback (for X.21 only)

The Verify Loopback is a toggle selection. It is used to verify that the DCE (local or remote) is in the loopback mode before running the BERT. When Verify Loopback is enabled, the DA-3x sends the initialization test frame to the DCE and then waits for a loopback confirmation from the DCE (local or remote) before running the BERT. When Verify Loopback is disabled, the DA-3x sends the initialization test frame to the DCE and starts running BERT without waiting for loopback confirmation from the DCE.

To enable/disable loopback verification, follow these steps:

1. Using the Up/Down Arrow keys, position the highlight bar on the Verify Loopback selection.

   Figure 3-16 shows the Verify Loopback selection when loopback verification has been enabled.

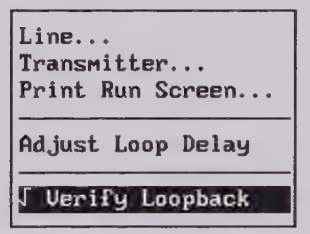
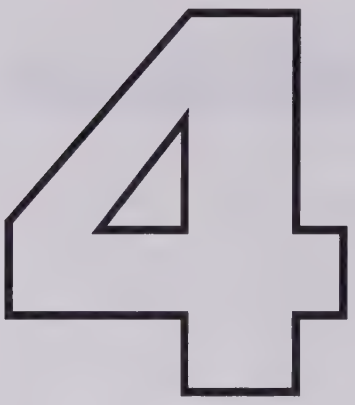


   Figure 3-16 Verify Loopback: Enabled

   When enabled, a √ symbol appears to the left of the selection. When disabled, nothing appears to the left of the selection.

2. Press Enter to enable/disable loopback verification. If loopback verification is not already enabled, pressing Enter enables it. Otherwise, pressing Enter disables it.



Performing the BERT

This chapter provides information on performing BERT. It also provides information on performing loopback initialization for a local and a remote DCE.

4.1. Overview of the Test

Before running the BERT, make sure you have made all necessary changes to the line setup and the transmitter setup. For more information on BERT test setup, refer to Chapter 4, "BERT Test Setup."

The BERT Application Run pull-down menu provides three options:

- Local LoopBack (for X.21 & V.24 only)
- Remote LoopBack (for X.21 & V.24 only)
- BERT

The Run pull-down menu is shown in Figure 4-1.

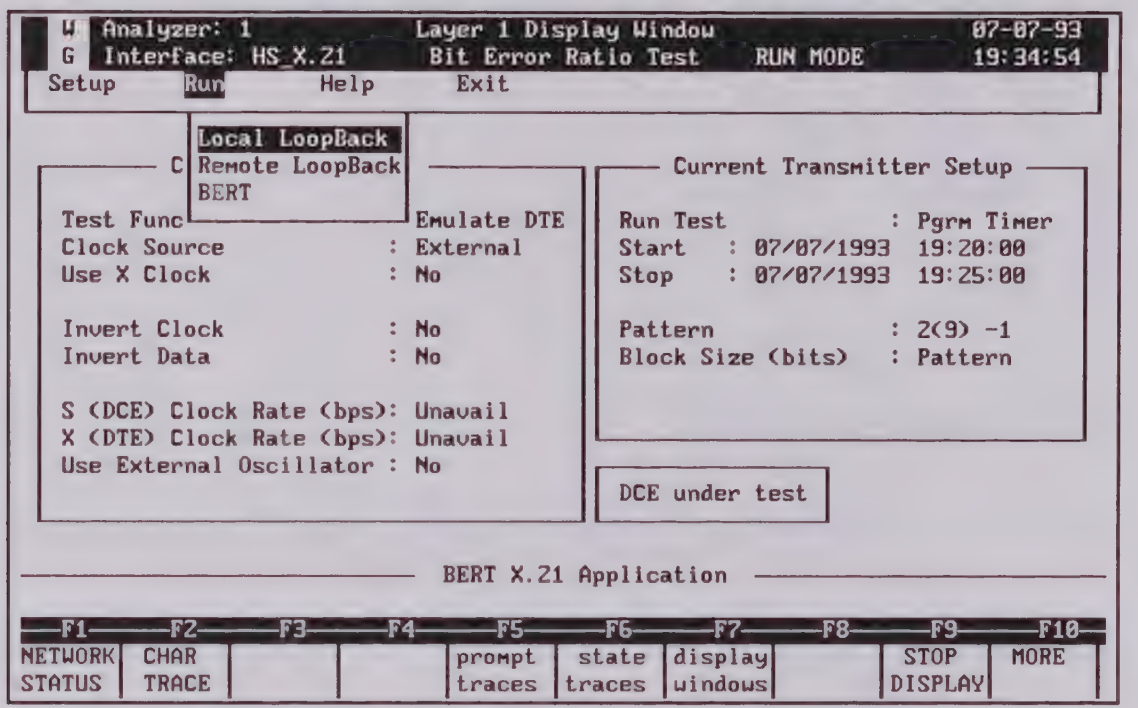


Figure 4-1 Run Pull-down Menu

The following sections provide information on these options along with the on-screen results of the tests.

4.2. Local LoopBack (for X.21 & V.24 only)

This selection causes the DA-3x to initialize the local DCE for loopback before running the BERT. Be sure your test setup is in a local loopback configuration and the DA-3x is setup for DTE emulation before making this selection.

To perform local loopback initialization, follow these steps:

1. Using the Up/Down Arrow keys, position the highlight bar on the Local LoopBack selection.
2. Press Enter to start local loopback initialization.

   If you decide that you do not want to perform local loopback, press Esc. You return to the BERT Main menu.

   If the DA-3x is not setup for DTE emulation, a warning message (Figure 4-2) is displayed.

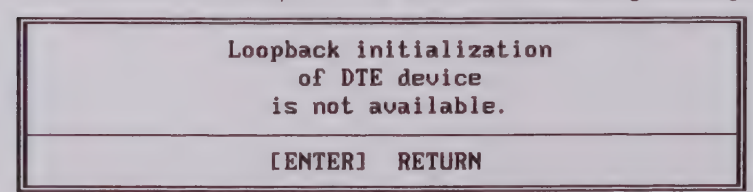


Figure 4-2 Warning Message: Loopback Not Available at DTE

If loopback verification is enabled (Verify Loopback selected) and the DA-3x does not receive loopback confirmation, the message shown in Figure 4-3 is displayed.

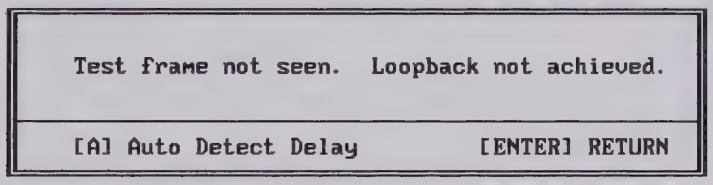


Figure 4-3 Message: Loopback Not Achieved

You can respond by pressing one of the two keys listed in Table 4-1.

Key	Action
A	the BERT Application attempts to automatically detect the loop delay from the DCE. The application searches for a suitable loop delay by alternately incrementing and decrementing (in 50 millisecond steps) the default delay of 10,000 milliseconds. An Automatic Loop Delay Adjustment window is displayed as shown in Figure 4-4. It is similar to the window described in Section 3.2.4, "Adjust Loop Delay."
Enter	returns you to the BERT Main menu.

Table 4-1 Responses: Loopback Not Achieved

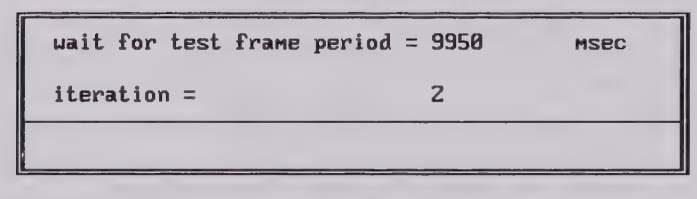


Figure 4-4 Automatic Loop Delay Adjustment Window

The fields of the Automatic Loop Delay Adjustment window are listed in Table 4-2.

Field	Indicates...
wait for test frame period =	the current loop delay value
iteration =	the current iteration of the automatic loop delay adjustment routine

Table 4-2 Fields of the Automatic Loop Delay Adjustment Window

If a suitable delay is found, a message—telling you that the loop delay (time-out) has been calculated—is displayed on the Automatic Loop Delay Adjustment window. See Figure 4-5. Press Enter to accept the loop delay value.

Sometimes, the loop delay search will return a value which, when used, does not fit the loopback verification specifications. In this case, simply disable loopback verification (Section 3.2.5, "Verify Loopback").

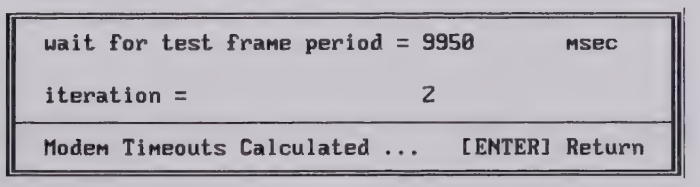


Figure 4-5 Automatic Loop Delay Adjustment Window: Suitable Delay Found

If the BERT Application cannot find a loop delay value that is less than or equal to 30,000 milliseconds (30 seconds) and greater than 500 milliseconds (0.5 seconds), it stops searching for loop delays and returns to the BERT Main menu.

Note:

Because various modems can have widely varying loop delay requirements, the automatic loop delay adjustment routine is not guaranteed to find a loop delay value that matches that of the modem you are testing. Therefore, if the loop delay search goes on for longer than you think is appropriate, simply press Esc to abort.

4.3. Remote LoopBack (for X.21 & V.24 only)

This selection functions in much the same way as the Local LoopBack selection. The only difference is that a remote—rather than local—loopback initialization is performed. This selection causes the DA-3x to initialize the remote DCE for loopback before running the BERT. Be sure your test setup is in a remote loopback configuration before making this selection.

To perform remote loopback initialization, follow these steps:

1. Using the Up/Down Arrow keys, position the highlight bar on the Remote LoopBack selection.
2. Press Enter to start remote loopback initialization.

   If you decide that you do not want to perform remote loopback, press Esc. You return to the BERT Main menu.

The DA-3x must be setup for DTE emulation in order to perform loopback. If not, a warning message (Figure 4-6) is displayed.

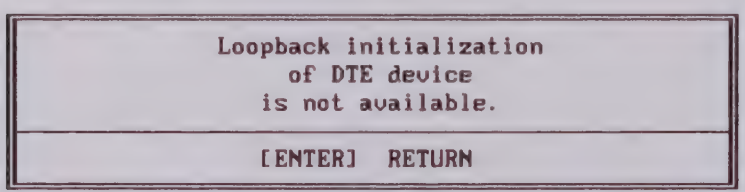


Figure 4-6 Warning Message: Loopback Not Available at DTE

If loopback verification is enabled (Verify Loopback selected) and the DA-3x does not receive loopback confirmation, the same messages and windows described in Section 4-2, "Local LoopBack" are displayed.

Note:

Version 1.0 of the BERT Application does not support software-initialized loopback for the V.35 and V.36 interfaces—only X.21 and V.24.

4.4. BERT

The BERT computes standard BERT statistics as defined in the CCITT G.821 Recommendation.

Before running BERT, be sure the device under test is also in the BERT mode. You should also be sure the Test Function field on the BERT Line Setup menu is set to one of the emulation settings. If it is not, the application will not allow you to perform a BERT, and a message box appears displaying the following warning:

"BERT cannot run unless configured for EMULATE"

If emulating a DTE, be sure the interface clocks are present. If they are not, the warning message shown in Figure 4-7(a) is displayed. If emulating a DCE, be sure that you have selected clock rates from the Clock Rate selection boxes. If you have not and leave the clock rate fields set to "Unavail," the warning message shown in Figure 4-7(b) is displayed.

```
DCE clock is not available.

[ENTER]  RETURN
```

Figure 4-7(a) No Clock Warning Message (when emulating a DTE)

```
No Clock Rate detected.  Cannot enter BERT.

[ENTER]  RETURN
```

Figure 4-7(b) No Clock Warning Message (when emulating a DCE)

The BERT Statistics screen is shown in Figure 4-8.

```
W Analyzer: 1          Layer 1 Display Window                07-07-93
G Interface: HS_X.21    Bit Error Ratio Test    RUN MODE      19:45:18
                                                              Sync = ON
BERT (G.821) Stats        Total          Ratio        Status
Test Seconds              3.5  E+01                   Elapsed Time: 00:00:36
Blocks Received           0.0                         Pattern     : 2(9) -1
Bits Received             1.4  E+01                   Block Size  : Pattern

Bit Errors                0.0            0.0          Line Rate : 9600    bps
Blocks in Error           0.0            0.0          Prn Intrvl: OFF

Available Seconds         3.5  E+01      1.0  E+02
Available Minutes         5.833E-01      1.0  E+02

Degraded Minutes          0.0            0.0          Passed ( < 10 %  )
Severely Errored Seconds  0.0            0.0          Passed ( < 0.2 % )
Errored Seconds           0.0            0.0          Passed ( < 8 %   )

[ESC] Stop     [R] Reset Statistics     [I] Insert Bit Error     [P] Print Screen
                          BERT X.21 Application
 F1        F2        F3        F4        F5        F6        F7        F8        F9        F10
NETWORK   CHAR                          prompt    state     display             STOP      MORE
STATUS    TRACE                         traces    traces    windows           DISPLAY
```

Figure 4-8 BERT Statistics Screen

In the upper right corner of the screen, a synchronization status field reports synchronization status as shown in Table 4-3.

Synchronization Status	Meaning
Sync = ON	Synchronization between the DA-3x and the device under test (DTE or DCE) has been achieved.
Sync = OFF	Synchronization between the DA-3x and the device under test (DTE or DCE) has either been interrupted or has not yet been achieved. In the case of a loss of synchronization, all BERT statistics (discussed later) are frozen at their values prior to instant synchronization was lost. The counts are resumed as soon as synchronization is restored.

Table 4-3 Synchronization Status

The synchronization status determination is based on a percentage of bit errors detected during any given one-second interval. When this percentage exceeds a certain threshold, the BERT Application determines that synchronization on the transmission line has been interrupted (Sync = OFF). The synchronization threshold varies depending on the BERT test pattern being used. Table 4-4 lists the various threshold values.

Pattern Selection	Synchronization Threshold
2(9) - 1	20 %
2(11) - 1	15 %
2(15) - 1	15 %
2(20) - 1	1 %

Table 4-4 Synchronization Threshold Values

In the case of BERT_T1, a loss of framing does not necessarily cause a loss of synchronization. If the Framing field on the T1 Current Line Setup window is set to ESF (or ESFz) and a data stream that uses another framing method (e.g. UNFRAMED) is received, BERT_T1 will not lose synchronization. Although this results in a large number of bit and block errors, the rate of these errors is not high enough to cause BERT_T1 to lose synchronization.

Note:

When using any of the patterns larger than 2(11) - 1, be sure that you are running at one of the higher clock rates (i.e. greater than 256 k). Otherwise, line synchronization may never be achieved.

The rest of the screen is divided into four columns: BERT (G.821) Stats, Total, Ratio, and Status. The BERT (G.821) column reports the field name for each of the standard BERT statistics.

Table 4-5 provides information on the fields displayed on the BERT Statistics screen. Each of the statistics are updated every second.

Field	Indicates...
Test Seconds	The number of seconds that have elapsed since achieving synchronization (Sync = ON) between the DTE and DCE. If synchronization is lost (Sync = OFF), this count is stopped. The count resumes when synchronization is restored.
Blocks Received	The number of blocks received from the line.
Bits Received	The number of bits received from the line.
Bit Errors	The number of bit errors detected (Total column). The ratio (BER) of Bit Errors to Bits Received (Ratio column).
Blocks in Error	The number blocks in which 1 or more bit errors have been detected (Total column). The ratio of Blocks in Error to Blocks Received (Ratio column)
Available Seconds	The difference between Test Seconds and Unavailable Seconds (Total column). Unavailable Seconds are internally monitored and are not displayed. An unavailable second is defined as a one-second interval in which the BER is greater than or equal to 1×10^{-3}. However, the occurrence of ten consecutive seconds in which the BER does not equal or exceed 1×10^{-3} is considered available time. When this happens, the Unavailable Seconds count is decremented by 10, and the Severely Errored Seconds count is incremented by 10. The ratio of Available Seconds to Test Seconds multiplied by 100 (Ratio column).
Available Minutes	The Available Seconds represented as minutes (Total column). The ratio of Available Minutes to Test Seconds multiplied by 6000 (Ratio column).
Degraded Minutes	The number of available 60-second intervals—excluding Severely Errored Seconds—in which the BER exceeded 1×10^{-6} (Total column). The ratio of Degraded Minutes to Available Minutes multiplied by 100 (Ratio column).
Severely Errored Seconds	The number of one-second intervals in which the BER is greater than or equal to 1×10^{-3} (Total column). However, the occurrence of 10 consecutive severely errored seconds is considered unavailable time. When this happens, this count is decremented by 10, and the Unavailable Seconds counter is incremented by 10. The ratio of Severely Errored Seconds to Available Seconds multiplied by 100 (Ratio column).
Errored Seconds	The number of one-second intervals in which the BER was between 0 and 1×10^{-3} (Total column). The ratio of Errored Seconds to Available Seconds multiplied by 100 (Ratio column).

Table 4-5 BERT Statistics Screen Fields

The Total column reports the total counts associated with each of the statistics fields in the following scientific notation format (to four significant figures):

0.0000E+/-00

The Ratio column reports the ratios for the Bit Errors, Blocks in Error, Available Seconds, Available Minutes, Degraded Minutes, Severely Errored Seconds, and Errored Seconds fields. These ratios are reported as percentages in the scientific notation format (to four significant figures).

There are two text strings that may also appear in the Ratio column: "NaN" (Not a Number) and "Inf" (Infinity). "NaN" is displayed whenever the ratio evaluates to an indeterminate value (e.g. result of a division by zero). "Inf" is displayed whenever the ratio evaluates to a number too large to be represented in the scientific notation format.

The Status column reports:

- Elapsed Time: The amount of time that has elapsed since entering Run Mode.
- Pattern: The test pattern being used—expressed as a polynomial
- Block Size: The size (in bits) of a block. This field displays the text string "Pattern" because the block size defaults to the size of the test pattern. Table 4-6 shows the number of bits that correspond to the available patterns.

Pattern	Block Size (bits)
2(9) - 1	511
2(11) - 1	2047
2(15) - 1	32767
2(20) - 1	1048575

Table 4-6 Block Sizes for Test Patterns

- # of Chan: The number of channels operating at the rate shown in the Line Rate field. This field is shown only when running the BERT_T1 application.
- Line Rate: The clock rate as set on the Clock Rate Selection window (Figure 3-3) or detected on the line. If running the BERT_T1 application, the line rate is displayed in "kbps" (kilobits per second). For the other interfaces, the line rate is displayed in "bps" (bits per second).
- Prn Intrvl: The print period as set on the Print Screen Period selection window (Figure 3-14).
- The Pass/Fail status of the following fields: Degraded Minutes, Severely Errored Seconds, and Errored Seconds. Table 4-7 shows the possible status messages and their meaning.

Field	Status Message	Indicates...
Degraded Minutes	Passed (< threshold 10%)	the ratio is less than the G.821 10% threshold.
Severely Errored Seconds	Passed (< threshold 0.2%)	the ratio is less than the G.821 0.2% threshold.
Errored Seconds	Passed (< threshold 8%)	the ratio is less than the G.821 8% threshold.

Table 4-7 G.821 Threshold Values

At the bottom of this screen, a few important keys are listed. These keys have special functions while you are performing the BERT. See Table 4-8.

Key	Function
Esc	stops performing the BERT and returns you to the BERT Main menu
R	resets all the BERT statistics
I	inserts a single bit error into the data stream
P	outputs the BERT Statistics screen to a printer

Table 4-8 Relevant Keys for the BERT

PREFACE

This document provides information about the 2Mbps - ETSI applications available with Release 3.4.4. Each application includes a description of:

- the LIP's and LPP's necessary to run the application
- what the application does
- when to use the application
- setup instructions
- how to use the application
- directions for viewing results
- directions for exiting the program

On-line application notes are available for each application. These notes provide a description of the application, and explain when and why to use the application.

This document assumes a basic knowledge of the DA-3x. Refer to the *DA-30 /31 Operating Manual* for detailed DA-3x operating instructions.

Note:

Each W&G application is designed to solve a specific type of network problem. Because each network's troubleshooting needs are unique, the DA-3x provides you with the capability to customize applications (or develop your own) to suit your particular needs. If you change the setup of a W&G application, for example, by altering the loaded protocols or data logging, you must make corresponding changes to the application's Network Event Program. If you do not make these changes, the application may produce unpredictable results. Adding protocols may adversely affect application performance.

W&G provides custom applications. If you have specific application requirements, contact your sales representative to discuss a solution.

TABLE OF CONTENTS

MONHS_2M Monitor Traffic on a 2Mbps Network 1
BERT_2M Bit Error Ratio Test on a 2Mbps Network

Application Name	Application Description
MONHS_2M	Monitor Traffic on a 2 Mbps Network

Detailed Program Description

Loaded Layer Protocol Packages: HS_2MBPS

This application monitors and provides Network Status information on ETSI and CCITT G.703-compliant 2 Mbps networks. A Character Trace display shows the frame data sent and received on the network. MONHS_2M is the default 2 Mbps - ETSI application. The DA-3x automatically loads this application upon power-up if the 2 Mbps - ETSI Line Interface Module is the first one loaded in Slots 4-7.

MONHS_2M passively monitors all or a portion of a 2 Mbps data stream and gathers statistics on any combination of time slots within a 2 Mbps frame.

Setup: The application supports two basic monitoring configurations: Off Line and Through.

For the Off Line configuration, connect the receiver ports (RX1 and RX2) of the 2 Mbps - ETSI Line Interface Module to the protected monitor jacks (if provided) of the Network Equipment. Then configure both receivers to terminate the line (see Section 3.1.2.1, "Rx Termination" in the 2 Mbps - ETSI chapter of the *DA-30/31 Line Interface Operation* binder). Using these jacks is the preferred method of unobtrusive monitoring because their high impedance provides the best protection for your 2 Mbps network. However, if protected monitor jacks are not provided, you can vary this configuration by using wire taps. Tap both of the transmission links and connect each one to a receiver port on the 2 Mbps - ETSI Line Interface Module. Then configure both receivers to bridge line terminations (see Section 3.1.2.1, "Rx Termination" in the 2 Mbps - ETSI chapter of the *DA-30/31 Line Interface Operation* binder).

For the Through configuration, connect the transmit port of the Network Equipment to the RX1 port of the 2 Mbps - ETSI Line Interface Module. Connect the TX port to the receive port of the CPE. Then simply tap the other transmission link (from the CPE to the Network Equipment) and connect it to the RX2 port.

> **Note:**
>
> For more information on setting up the DA-3x to monitor a 2 Mbps network, refer to the "2 Mbps - ETSI" chapter of the *DA-30/31 Line Interface Operation* binder.

Input: None required.

Results: View network information in the Network Status or Character Trace Display Windows.

Program Exit: Press Alt-Menu to return to the DA-3x Main Menu. Press Alt-Exam to go to Examine Mode.

Bit Error Ratio Test Application for 2Mbps - ETSI

(BERT_2M)

PREFACE

Purpose and Scope

This document describes how to load and operate the Bit Error Ratio Test (BERT) Application which runs on the Wandel & Goltermann DA-3x Protocol Analyzer. The BERT Application allows you to perform loopback and bit error testing on transmission lines, Wide Area Network (WAN) interconnect devices (e.g. DTE, DCE, etc.). You should have a working knowledge of WANs, DTE and DCE devices, and BERT error statistics to use this application. This document assumes a basic knowledge of the DA-3x. Refer to the *DA-30/31 Operating Manual* for detailed operating instructions.

Requirements

The BERT Application runs on the DA-3x under Release 3.4.4 of the core software. If you are running an earlier version of the core software on your DA-3x, you need to upgrade to Release 3.4.4.

There are six versions of the BERT Application—one for each of the supported line interfaces. These applications and their corresponding line interfaces are:

Application	**Line Interface**
BERT_X21	X.21 Line Interface
BERT_V24	V.24 Line Interface
BERT_V35	V.35 Line Interface
BERT_V36	V.36 Line Interface
BERT_T1	T1 Line Interface
BERT_2M	2MBPS - ETSI Line Interface

Load and run the application that is appropriate for the WAN line interface under test.

Note:

Although this document describes the operation for all of the above-mentioned BERT applications, many of the screens, windows and menus that are used as examples correspond to those displayed by the BERT Application for the X.21 interface (BERT_X21). Any interface-specific differences in these screens, windows and menus are noted in the appropriate sections.

Before running the BERT Application, you need to have a High Speed WAN Feature Module and WAN Line Interface Module combination installed in slots 4 and 5 or slots 6 and 7 of your DA-3x. Also, the latest version of the High Speed WAN Line Interface Package—that corresponds with your interface—must be installed on your DA-3x's hard disk.

How This Manual Is Organized

This document is organized into the following chapters:

Chapter 1, Getting Started	introduces the BERT Application, describes what the application does and when it should be used. This chapter also provides instructions for connecting the DA-3x to the device under test and for loading and running BERT.
Chapter 2, BERT Basics	describes the components of the BERT Main menu, describes on-line help and the softkey rack, indicates where to find procedures for loading the application and using it to perform BERTs, and details the difference between the BERT Application's two operational modes.
Chapter 3, BERT Test Setup	describes how to set up the BERT line interface and transmitter options.
Chapter 4, Performing the BERT	provides information on performing the loopback (local and remote) and BERT. It also provides information on interpreting BERT statistics.

Revision History

The following is the revision history for the Bit Error Ratio Test (BERT) Application document.

First Edition	October 1993
Second Edition	November 1993
Third Edition	November 1994

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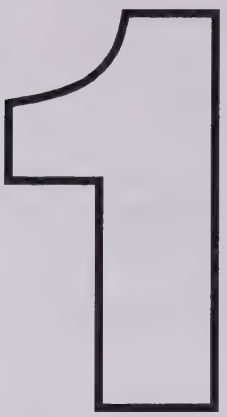


Getting Started

This chapter introduces the Bit Error Ratio Test (BERT) Application and describes what the application does and when it should be used. It also provides instructions for connecting the DA-3x to the device under test (DTE or DCE) and for loading and running the BERT Application.

1.1. What Does the BERT Application Do?

The BERT Application enables the DA-3x to test the reliability of a digital transmission channel between a DTE and local or remote DCE. It also enables the DA-3x to check the functioning of local and remote DCEs.

BERT testing involves a transmitter and receiver that independently generate the same bit (test) pattern. The BERT Application enables the DA-3x to act as a BERT tester. Generally, a BERT tester generates a test pattern which is transmitted by its BERT transmitter to the device under test. The pattern is then looped back to its own BERT receiver on the channel that is under test. This allows for duplex (transmit and receive) line testing with only one BERT tester. The pattern can also be sent from the transmitter of one BERT tester, passed through the device under test, and received by a second BERT tester. This allows for simplex (transmit or receive) line testing.

When the DA-3x receives a test pattern, it compares the received pattern to the specified test pattern (generated in the receiver) to determine whether errors occurred.

1.2. Off-Line Only!

The BERT Application is an off-line test tool. In the BERT mode, only BERT statistics are valid. All other network/interface statistics that can be accessed via the softkey rack (e.g. Network Summary, Character Trace, etc.) are unreliable.

1.3. When Should You Use the BERT Application?

The error statistics and performance parameters provided by BERT can be used:

- to check the proper operation of a local or remote DCE or CPE
- as acceptance criteria for testing interconnection devices (e.g. repeaters) before installation on a live network
- to check the reliability of the transmission channels, as a restart test, whenever an interconnection device is upgraded or expanded

Note:

A transmission channel consists of interface cables as well as any interconnecting devices inserted on the line.

1.4. What Hardware and Software Is Needed?

The BERT Application is a single analyzer application. To run the BERT Application, you must have a High Speed WAN Feature Module and a WAN Line Interface Module installed in the interface slots of your DA-3x. The High Speed WAN Feature Module and WAN Line Interface Module (V.24, V.35, V.36, X.21, T1 or 2MBPS - ETSI) must be installed in adjacent interface slots (slots 4 and 5 or slots 6 and 7). Moreover, you must have a Protocol Analyzer Module installed in slot 2 or 3.

Caution:

Do not attempt to run the BERT Application as a dual analyzer application. You risk the corruption of the BERT test pattern files.

The DA-3x Main Menu, as shown in Figure 1-1, reflects the instrument's architecture.

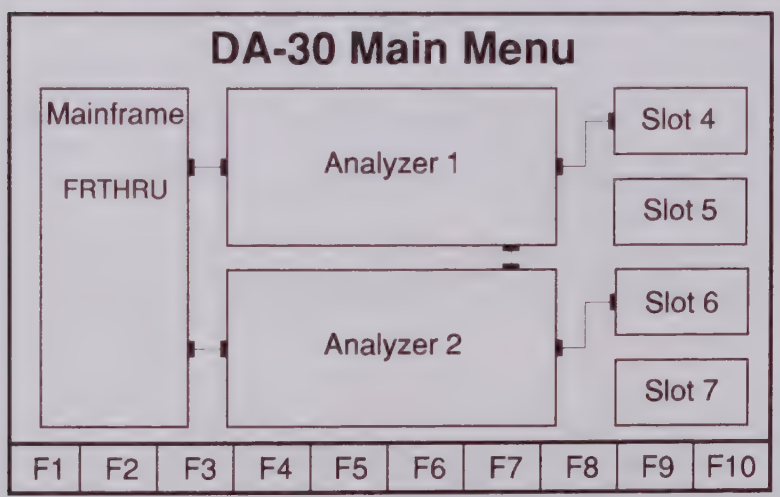


Figure 1-1 DA-3x Main Menu (reflecting the instrument's architecture)

Slot 2 or 3 contains the analyzer module. If the analyzer module is in slot 2 (Analyzer 1) then the High Speed WAN Feature Module and the WAN Line Interface should occupy slots 4 and 5. If the analyzer module is in slot 2 (Analyzer 2) then the High Speed WAN Feature Module and the WAN Line Interface should occupy slot 6 and 7.

You must also have the following software loaded on your DA-3x's hard disk.

- Release 3.4.4 (or later) Core Software
- High Speed WAN Line Interface Package

1.5. Connecting to the Device Under Test

A generic diagram of a Wide Area Network (WAN) is shown in Figure 1-2. The DA-3x can be configured to emulate the local DTE, the local DCE, the remote DTE or remote DCE in this diagram.

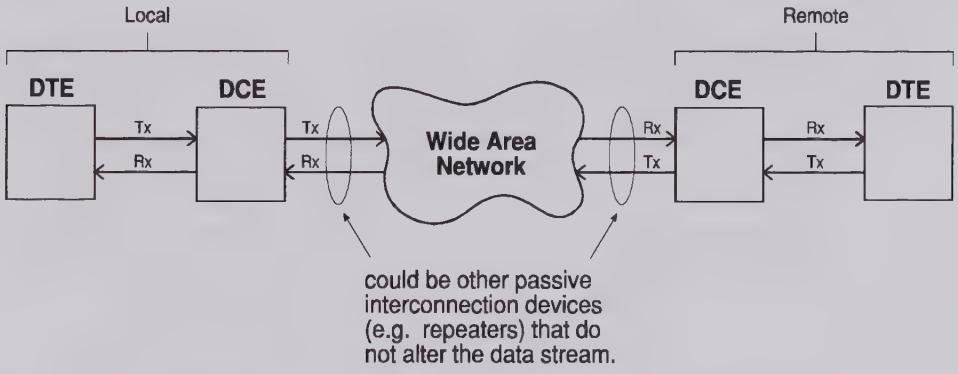


Figure 1-2 Generic WAN Diagram

The testing configurations basically fall into two categories: Loopback configurations and Thru (Non-loopback) configurations.

The Loopback configurations allow a single DA-3x to be used for BERT testing on both transmit and receive lines simultaneously. The BERT Application provides software initialization for local and remote loopback on the X.21 and V.24 Line Interfaces only. Loopback can be achieved on the other interfaces by using an additional loopback cable. In any case, before performing loopback, the DA-3x must be setup for DTE emulation.

Figure 1-3 shows a local loopback configuration that allows the DA-3x to test the functioning of the local DCE as well as the reliability of both the transmit and receive lines (duplex) at the local DTE-DCE interface.

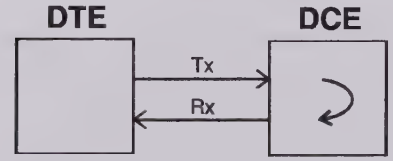


Figure 1-3 Local Loopback Configuration

Figure 1-4 shows a remote loopback configuration that allows the DA-3x to test the functioning of the remote DCE, the reliability of the transmit and receive lines at the local DTE-DCE interface as well as the WAN transmission path from the local DCE to the remote DCE and back.

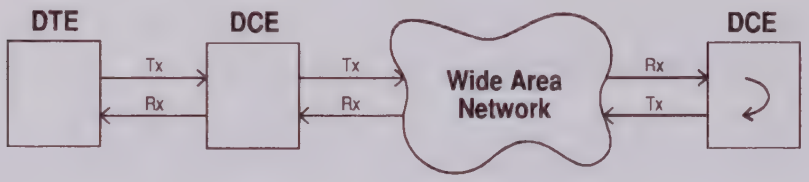


Figure 1-4 Remote Loopback Configuration

To perform loopback using an X.21 interface, you simply connect a DB15 cable between the DA-3x's DTE connector and the appropriate connector of the local DCE as shown in Figures 1-3 and 1-4. To perform loopback using the V.24 interface, however, requires the use of the auxiliary pins (AUX 1 and AUX 2) located on the rear panel of the V.24 Line Interface Module (LIM). This can be accomplished by building a special DB25 cable that breaks out pins 18 and 25 from the end that attaches to the DA-3x's DTE connector (Figure 1-5). Pin 18 should then be connected to AUX 1, and pin 25 should be connected to AUX 2. Connect the other end of the cable to the appropriate connector on the local DCE.

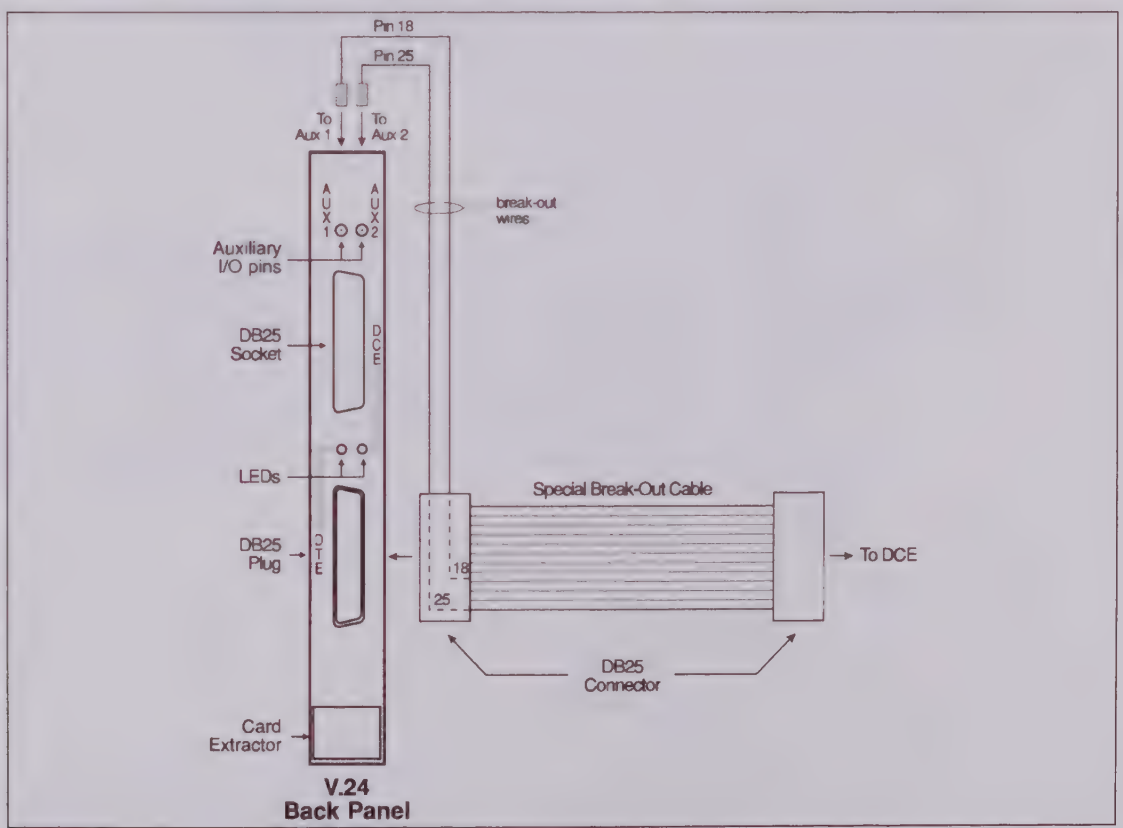


Figure 1-5 Special Break-Out Cable for V.24 Loopback

The Thru configurations limit you to simplex line testing (transmit or receive). Only some DCE functionality is tested. In the following Thru configurations, the DA-3x can be setup to emulate either the DTE or the DCE. Moreover, a second DA-3x (or another BERT tester—one setup for DTE emulation, the other setup for DCE emulation—could be used to test both the transmit and receive paths simultaneously. Of course, both testers must be in the BERT mode.

Note:

The terms "DTE" and "DCE" are used in the following discussion of the Thru configurations. However, if you are testing on either a T1 or E1 network, the term "DTE" corresponds to a CPE (Customer Premises Equipment), and the term "DCE" corresponds to a network terminating device like a Channel Service Unit (CSU). When connecting your T1 interface, use only the CPE ports. They are labeled "To Net" on the rear panel. When connecting your 2MBPS - ETSI interface, use only the TX and the RX2 connectors on the rear panel.

Figure 1-6 shows a configuration that allows the DA-3x to test the reliability of the receive line at the local DTE-DCE interface (if emulating a DTE) or the transmit line at the local DTE-DCE interface (if emulating a DCE).

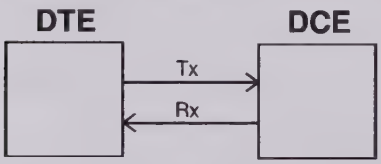


Figure 1-6 Thru Configuration 1

Figure 1-7 shows a configuration that allows the DA-3x to test the reliability of the receive line at the local DTE-DCE interface and the WAN transmission path from the remote DCE to the local DCE (if emulating a local DTE). This configuration also allows the DA-3x to test the reliability of the transmit line at the local DTE-DCE interface and the WAN transmission path from the local DCE to the remote DCE (if emulating a remote DCE).

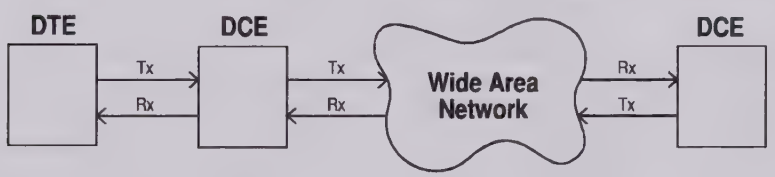


Figure 1-7 Thru Configuration 2

Figure 1-8 shows a configuration that allows the DA-3x to test the reliability of the transmit line at the remote DTE-DCE interface and the WAN transmission path from the remote DCE to the DA-3x (if emulating a local DCE). This configuration also allows the DA-3x to test the reliability of the receive line at the remote DTE-DCE interface and the WAN transmission path from the local DCE to the remote DCE (if emulating a remote DTE).

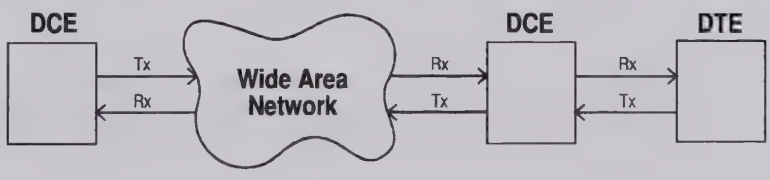


Figure 1-8 Thru Configuration 3

If you are testing on a T1 network, you have an additional connection possibility. The T1 interface can be connected, in series, between a CPE and a CSU. The incoming traffic (Tx or Rx line) is received on the "TO NET" IN connector, routed through the T1 interface, and sent back out on the "TO CPE" OUT connector. Once connected, the T1 interface should be configured in a "pass-through" mode by setting the Test Function field (on the Line Setup menu) to RECEIVE ONLY. The "pass-through" mode does not allow error insertion.

Prior to running BERT, you need to connect the DA-3x to the device under test as shown in Figure 1-9.

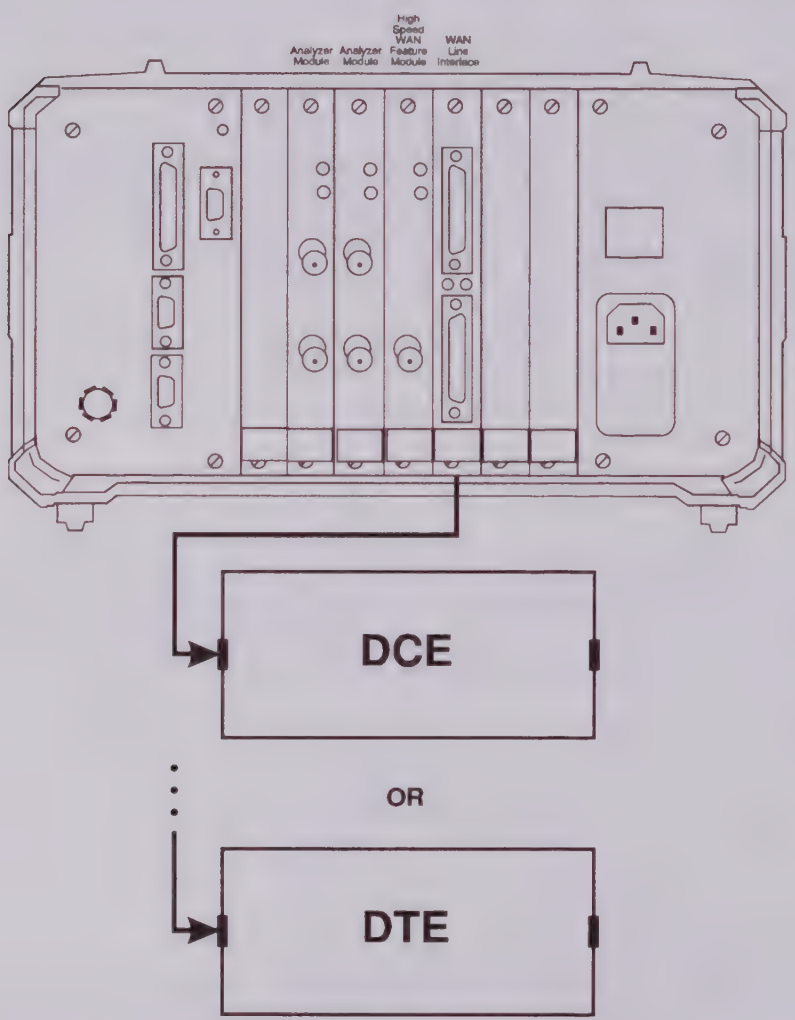


Figure 1-9 Connecting the DA-3x to the Device Under Test

For more detailed information on how to connect your particular interface, refer to the appropriate line interface section of the *DA-30/31 Line Interface Operation* binder.

Note:

All of the above Thru configurations are not typical test setups. However, they can be useful in laboratory settings when testing experimental networks, interconnecting devices, etc.

1.6. Loading and Running the BERT Application

In order to use the BERT Application, you need to load it into the DA-3x's memory and then go to Run mode. To load and run BERT, follow these steps:

1. From the DA-3x Main Menu, position the cursor on the Current Application field of the Mainframe window. Then press F1 (view options) to access the Application Management menu.
2. Using the Up Arrow or Down Arrow, position the cursor on the Application Group that leads to the BERT Application and press Enter. The list of available applications and subgroups appears. Continue searching through the subgroups of the tree structured directory until you reach the group containing the BERT Application.
3. Using the Up Arrow or Down Arrow, position the cursor on the BERT Application. Press Enter to load and run the application or press F1 (LOAD AS IS) to load the application and return to the DA-3x Main Menu.

From the DA-3x Main Menu, if the BERT Application has already been loaded, you can run BERT by simply pressing Alt-Run.

1.7. Modifying the Line Setup

BERT requires the line setup to be compatible with your network for the application to run. Refer to the appropriate line interface section of the *DA-30/31 Line Interfaces Operation* binder for information on modifying the line setup for the interface you are using.

1.8. What Should You Do If You Get Lost?

If you get lost or unable to return to a particular screen when you first start using the BERT Application, the information in Table 1-1 may be helpful.

If you are viewing...	And you want to...	Then...
The BERT Statistics screen or any BERT menu	Return to the BERT Main menu	Press Esc until the BERT Main menu appears
Any BERT screen or menu	Return to the DA-3x Main menu	Press Alt-menu (or Ctrl-M)
The BERT Main menu	Display on-line help information	Select Help from the BERT Main menu
Any DA-3x Run Mode screen	Return to BERT Main menu	Press F12 to display the top level softkey rack. Then press F10 (MORE) and F1 (APPL SCREEN)

Table 1-1 Menu Navigation Summary

1.9. Exiting the Application

You may want to exit BERT occasionally and return to the DA-3x's Main Menu, for example, if you have finished transmitting BERT test patterns and want to run another DA-3x application. You must return to the DA-3x's Main Menu before loading a different application. The Exit-MENU option on the Exit pull-down menu allows you to return to the DA-3x's Main Menu. Simply follow these steps:

1. Select Exit-MENU from the Exit pull-down menu.
2. The DA-3x exits BERT and returns to Menu mode.

However, to quickly return to the DA-3x's Main Menu, you could also press Alt-Menu (or Ctrl-M).

1.10. Where to Go for More Information

Refer to the remaining chapters of this manual for detailed information about the application. If you would like more information about loading and running applications, refer to Chapter 4, "Applications" of the *DA-30/31 Operating Manual*.

For more information on BERT statistics and performance parameters, see *CCITT Recommendation G.821*.

2

BERT Basics

This chapter describes the components of the BERT Main menu and details the difference between BERT's two operational modes.

2.1. The BERT Main Menu

When you run the BERT Application, the BERT Main menu appears, as shown in Figure 2-1.

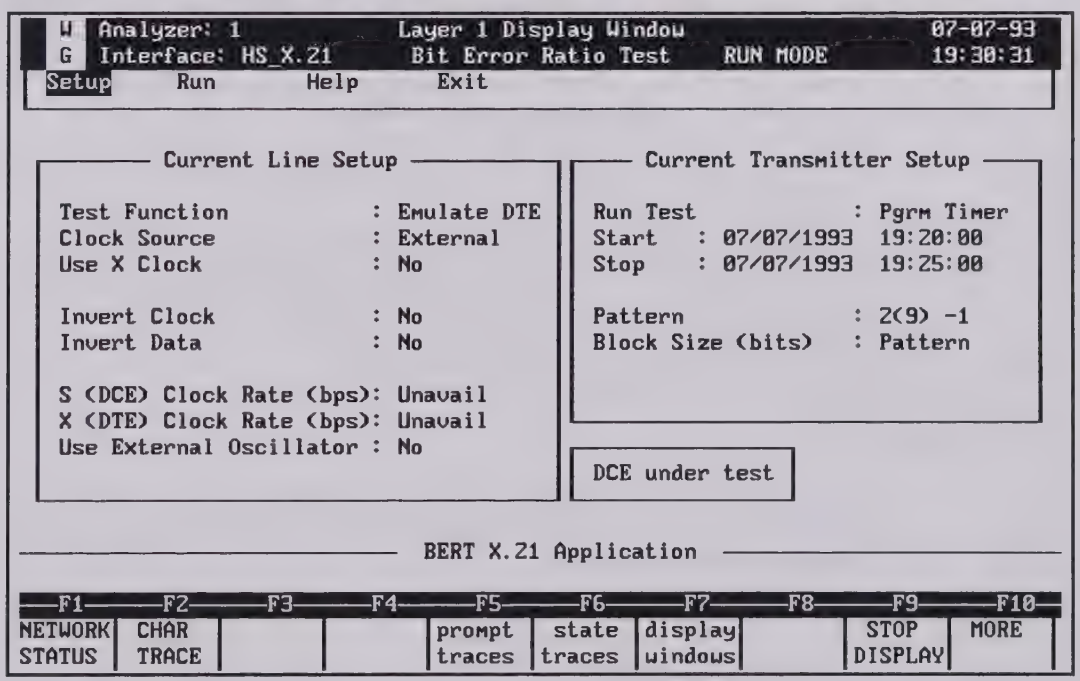


Figure 2-1 BERT Main Menu

The components of the BERT Main menu include:

- menu bar
- current line setup window
- current transmitter setup window
- device under test window
- prompt line
- Run mode softkey rack

These components are described in the following sections.

2.1.1. Menu Bar

The menu bar is located at the top of the screen. It contains the keywords for the application's pull-down menus as shown in Table 2-1.

Menu Item	Provides options for...
Setup	configuring the line interface and BERT transmitter. Setting the period for automatic printing of the statistics screen. Enabling the loopback verification and automatic loop delay calculation.
Run	selecting a loopback initialization (local or remote) to be performed on the device under test before BERT execution or for executing BERT directly. Loopback is available for the X.21 and V.24 interfaces only.
Help	displaying helpful information about BERT including keyboard and version number information
Exit	exiting BERT Application and returning to DA-3x's Main Menu

Table 2-1 Menu Bar Items

Use the Right Arrow or Left Arrow key to move among the menu bar items. To display the pull-down menu for a menu item, position the cursor on the keyword (such as Setup) and press Enter. On the pull-down menu, you can use the Up/Down Arrow keys to position the cursor on a desired item and press Enter to select it.

2.1.2. Current Line Setup

The BERT Current Line Setup window appears when you run the application. BERT displays this window whenever you are at the BERT Main menu. This window summarizes the current settings for the line interface.

The setup fields shown are a subset of the line settings available from the Line Setup menu accessed via the interface slot window (DA-3x Main Menu). The settings for these fields, at the time the BERT Application is run, are used as the application's default settings. These settings can, of course, be modified within the BERT Application via the Line option on the Setup pull-down menu. However, when you exit the BERT Application, the original line settings are not altered.

Because the setup fields actually displayed in the Current Line Setup window vary depending on the interface that you have installed, a discussion of these fields has been reserved for Section 3.2.1, "Line Setup." Refer to the sub-section that corresponds to your interface (e.g. Section 3.2.1.1, "X.21 Line Setup" for the X.21 interface).

2.1.2.1. V.24, V.35, V.36 and X.21

The Current Line Setup window for the V.24, V.35, V.36 and X.21 interfaces resembles the one shown in Figure 2-2.

```
Current Line Setup

Test Function              : Emulate DTE
Clock Source               : External
Use X Clock                : No

Invert Clock               : No
Invert Data                : No

S (DCE) Clock Rate (bps): Unavail
X (DTE) Clock Rate (bps): Unavail
Use External Oscillator : No
```

Figure 2-2 Current Line Setup Window for X.21

The DA-3x automatically checks the clock lines for the presence of clock signals when you run the BERT Application. During this process, the text string "Determining line-speed..." is displayed at the bottom of the screen.

If a clock is present, its frequency is calculated and displayed in the clock rate fields. In addition, the text string "Line-speed detection done" is displayed at the bottom of the screen. Whenever an expected external clock signal is not detected, the "Unavail" text string is displayed instead.

2.1.2.2. T1

The Current Line Setup window for the T1 interface looks like the one shown in Figure 2-3.

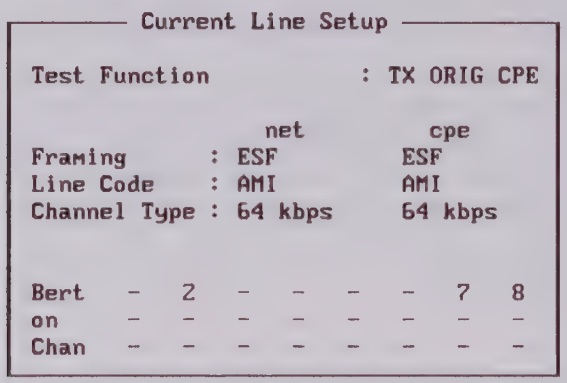

Current Line Setup
Test Function : TX ORIG CPE
net cpe
Framing : ESF ESF
Line Code : AMI AMI
Channel Type : 64 kbps 64 kbps
Bert - 2 - - - - 7 8
on - - - - - - - -
Chan - - - - - - - -

Figure 2-3 Current Line Setup Window for T1

This window reports the framing format, the line code, and the channel type for both sides of the interface (CPE and NET). It also provides a summary of the channels that are currently being used for BERT.

2.1.2.3. 2MBPS - ETSI

The Current Line Setup window for the 2MBPS - ETSI interface looks like the one shown in Figure 2-4.

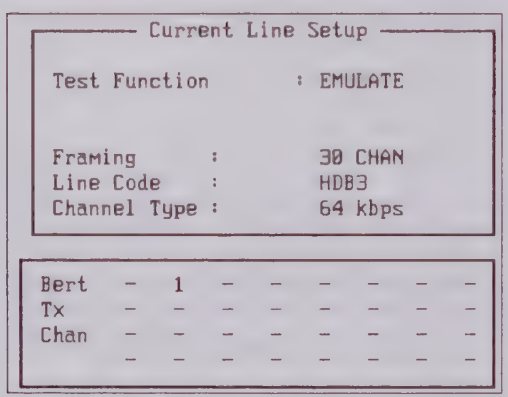


Figure 2-4 Current Line Setup Window for 2MBPS - ETSI

This window reports the framing format, the line code, and the channel type that are being used for the interface. It also provides a summary of the channels that are currently being used for BERT.

2.1.3. Current Transmitter Setup

The BERT Current Transmitter Setup window (Figure 2-5) appears when you run the application. BERT displays this window whenever you are at the BERT Main menu.

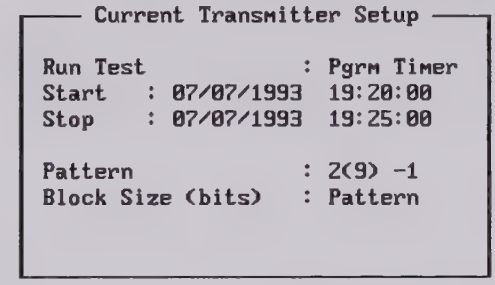

Current Transmitter Setup
Run Test : Pgrm Timer
Start : 07/07/1993 19:20:00
Stop : 07/07/1993 19:25:00
Pattern : 2(9) -1
Block Size (bits) : Pattern

Figure 2-5 Current Transmitter Setup Window

This window summarizes the current settings of the BERT transmitter. These settings can be modified via the Transmitter option on the Setup pull-down menu.

Table 2-2 describes the fields shown on the Current Transmitter Setup Window.

Current Transmitter Setup Field	**Displays...**
Run Test	one of the following text strings: "Continuous" when the BERT timer is in the Continuous mode "Stop Timer" when the BERT timer is in the Programmed Stop mode "Pgrm Timer" when the BERT timer is in the Programmed Start/Stop mode The modes of the BERT timer are discussed in Section 3.2.2.1, "Time Setting."
Duration	the test duration. This field appears only when the BERT timer is in the Programmed Stop mode. The date is shown in the mm/dd/yyyy format followed by the duration in the hh:mm:ss format. See Section 3.2.2.1, "Time Setting."
Start	the start time of the test. This field appears only when the BERT timer is in the Programmed Start/Stop mode. The date is shown in the mm/dd/yyyy format followed by the start time in the hh:mm:ss format. See Section 3.2.2.1, "Time Setting."
Stop	the stop time of the test. This field appears only when the BERT timer is in the Programmed Start/Stop mode. The date is shown in the mm/dd/yyyy format followed by the stop time in the hh:mm:ss format. See Section 3.2.2.1, "Time Setting."
Pattern	the selected test pattern expressed as a polynomial. See Section 3.2.2.2, "Patterns."
Block Size (bits)	the text string "Pattern" which indicates that the block size is the same as the pattern size. See Section 4.4, "BERT."

Table 2-2 Transmitter Setup Window Fields

2.1.4. Device Under Test

The Device Under Test status field appears on the Main Menu for all the BERT applications except BERT_2M. This field is located underneath the Current Transmitter Setup window and reports the type of device that is being tested as shown in Table 2-3.

Test Status Message	Displayed when...
DCE under test	emulating a DTE. The Test Function is set to Emulate DTE on the Line Setup menu.
DTE under test	emulating a DCE. The Test Function is set to Emulate DCE on the Line Setup menu.
Mon under test	**X.21, V.24, V.35 and V.36 BERT Applications:** the Test Function—upon running the BERT Application—is set to Monitor on the Line Setup menu (accessed via the DA-3x Main Menu's interface slot window). However, because Monitor is not a valid Test Function setting for BERT, you are not allowed to perform a BERT until you change the Test Function to one of the emulation settings (e.g. Emulate DTE). **T1 BERT Application:** the Test Function—upon running the BERT Application—is set to RECEIVE ONLY on the Line Setup menu.
CPE under test	emulating a T1 network. The Test Function is set to TX ORIG NET or TX D&I NET on the Line Setup menu. For T1 only.
NET under test	emulating Customer Premises Equipment (CPE). The Test Function is set to TX ORIG CPE or TX D&I CPE on the Line Setup menu. For T1 only.

Table 2-3 Device Under Test Status

The Device Under Test status field is not used in the BERT_2M application. However, the same information is displayed in a status field in the top right corner of the screen. During BERT testing, the following status message is displayed:

```
RX2 under test
```

2.1.5. Prompt Line

The prompt line, displayed at the bottom of the screen provides information about key usage and explanations about current selections.

2.1.6. Online Help

Online help is provided for the BERT Application. A scrollable help screen is associated with each pull-down menu listed on the BERT Main menu bar. You can access these screens in one of two ways.

First, you can select the menu name and press the Help key. The same help screen is displayed whether you highlight only the menu's name or one of its options before pressing Enter.

Second, you can use the Help pull-down menu. The Help pull-down menu presents the choices listed in Table 2-4.

Help Option	Provides...
Getting Started	a brief description of the application. You can also access this screen by either highlighting the Help menu and pressing the Help key or by pressing the H (Help) key from any of the other help screens.
Keyboard	a list of the special keys and what they mean when used in the BERT Application.
About	general information about the application software such as the name, brief description, version number and copyright.

Table 2-4 On-line Help Options

2.1.7. Run Mode Softkey Rack

The Run Mode softkey rack, located at the bottom of the screen, consists of 10 softkeys labeled F1 to F10. These softkeys enable you to view various DA-3x displays and to change modes. The valid Run Mode softkeys for BERT and their associated functions are summarized in Table 2-5.

Softkey	Function
F1	Displays the Network Status screen.
F2	Displays the Character Trace screen.
F3	Displays the Protocol Trace softkey rack for the loaded protocols.
F5	Displays the Prompt Trace softkey rack. The Layer 1 prompt trace (F1) contains messages that are useful for tracking the activity of the BERT Application whenever you are uncertain of how the application is executing or you are trying to troubleshoot an abnormal condition.
F7	Displays the Display Window softkey rack. The Layer 1 Display Window contains the BERT Application screens.
F8	Switches between displaying the Run Mode and Exam Mode display screens for one analyzer or both analyzers simultaneously.
F9	Freezes the Run Mode display.
F10	The More key displays a second softkey rack that contains the following four softkeys: F1 changes to the current application's display window F2 switches to Exam Mode F3 switches to Menu Mode F4 goes to the currently defined DOS application

Table 2-5 Run Mode Softkeys and Their Functions

2.2. Procedure

To use BERT to test a DCE (local or remote) or a transmission channel, you need to perform the procedures listed below. Table 2-6 provides a reference for each procedure indicating where in this document you can find additional procedural information.

To do this...	Refer to...
Connect the DA-3x to the device to be tested	Section 1.5., "Connecting to the Device Under Test"
Load BERT	Section 1.6., "Loading and Running the BERT Application"
Run the application by pressing Alt-Run	Section 1.6., "Loading and Running the BERT Application"
Edit the WAN line interface or BERT transmitter setup and enable/disable loopback verification	Chapter 3, "BERT Test Setup"
Perform the BERT calculations	Chapter 4, "Performing the BERT"
View the results	Chapter 4, "Performing the BERT"

Table 2-6 Procedure for Testing with BERT

2.3. Setup Mode vs. Run Mode

BERT has two operational modes:

Setup mode — for configuring the line interface and BERT transmitter, enabling loopback verification and automatic loop delay adjustment, and setting the period for automatic printing of the statistics screen.

Run mode — for transmitting bit patterns, comparing received patterns, and calculating G.821 statistics.

When you load and run BERT, the application automatically places you in Setup mode. After completing the line and transmitter setup, you can go to Run mode by selecting one of the loopback options or the BERT option from the Run pull-down menu.

While the BERT test is being performed, BERT statistics are displayed on the application screen. Pressing Backspace always returns you to the application display window. If you are performing the BERT and want to return to the Current Setup screen, press Esc to stop the test and go to Setup mode.

BERT Test Setup

This chapter describes how to set up the WAN line interface and the BERT transmitter. It also describes how to enable/disable the loopback verification option as well as how to set the print interval for the automatic printing of the BERT statistics screen.

3.1. Overview of BERT Test Setup

Before performing the BERT, you need to make any necessary changes to the line and transmitter setup options. The options on the Setup pull-down menu allow you to set the emulation type, line speed; specify the clock source; select a BERT test pattern; and specify the test duration. This chapter provides information on these and other setup tasks.

You can run BERT using the default settings for all of these options or you can modify any or all of the values.

3.2. Setup

Figure 3-1 shows a sample Setup pull-down menu for the X.21 line interface. The options listed on the Setup menu depend on the WAN line interface that you have installed.

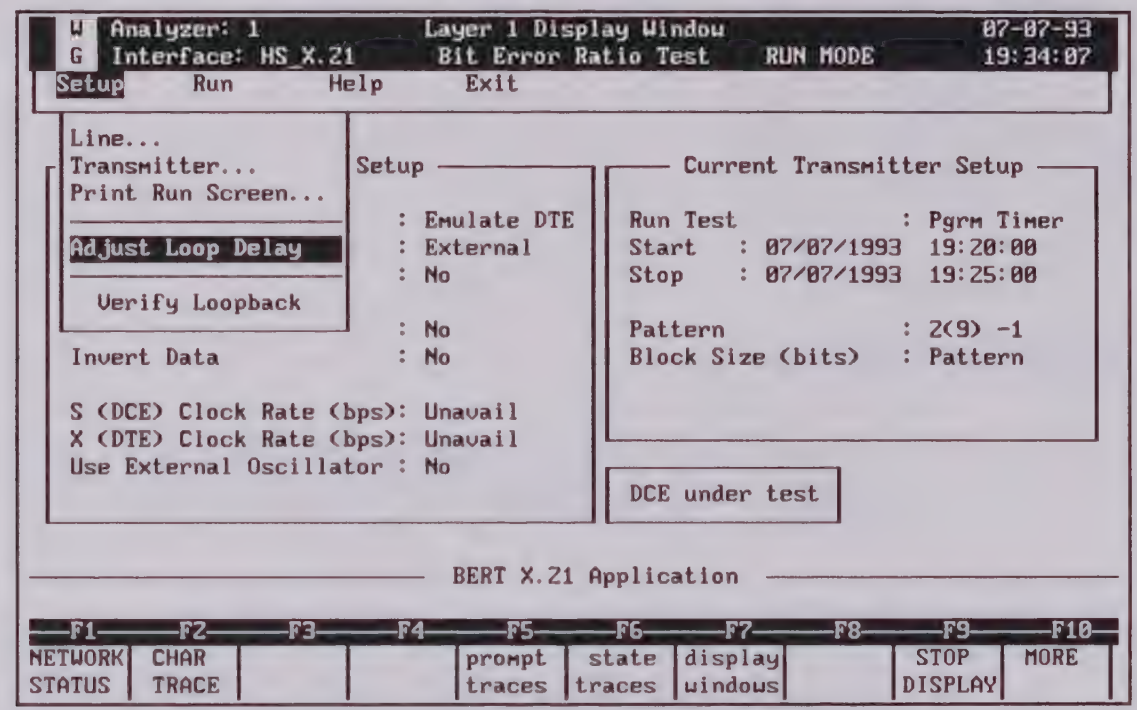


Figure 3-1 Setup Pull-down Menu

From the Setup pull-down menu, you can modify the following:

- Line Setup
- Transmitter Setup
- Print Run Screen
- Adjust Loop Delay (for X.21 only)
- Verify Loopback (for X.21 only)

To modify these parameters, highlight the appropriate selection and press Enter. Make the desired modifications and press Enter to return to the Setup pull-down menu. After making your changes, you can return to the BERT Main menu, from the Setup pull-down menu, by pressing Esc. The following sections provide information on the setup parameters.

3.2.1. Line Setup

The possible line setup options for the various line interfaces are shown and discussed in the following sections. The actual fields listed in the line setup window depend on the WAN line interface that you have installed. In any case, all fields shown are either toggle or data entry fields. For more detailed information on the fields for the various line interfaces, refer to the appropriate line interface section of the *DA-30/31 Line Interface Operation* binder.

3.2.1.1. X.21 Line Setup

Figure 3-2 shows the X.21 Line Setup Window and its default field settings.

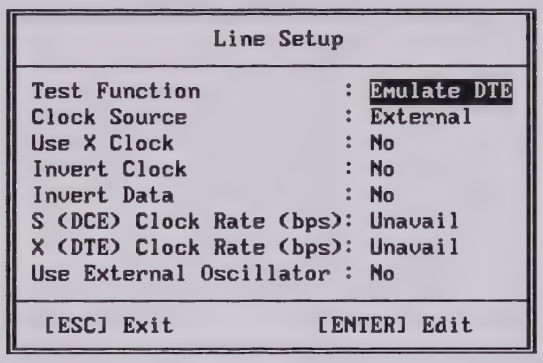

Line Setup
Test Function : Emulate DTE
Clock Source : External
Use X Clock : No
Invert Clock : No
Invert Data : No
S (DCE) Clock Rate (bps): Unavail
X (DTE) Clock Rate (bps): Unavail
Use External Oscillator : No
[ESC] Exit
[ENTER] Edit

Figure 3-2 X.21 Line Setup Window

The X.21 line setup options are listed in Table 3-1.

X.21 Line Setup Field	To modify...
Test Function	Toggle between Emulate DTE and Emulate DCE. Whenever this field is changed, the line speed is automatically re-determined before running BERT. Defaults to Emulate DTE.
Clock Source	Toggle between Internal and External. Whenever this field is changed, the line speed is automatically re-determined before running BERT. Defaults to External.
Use X Clock	Toggle between Yes and No. Defaults to No.
Invert Clock	Toggle between Yes and No. Defaults to No.
Invert Data	Toggle between Yes and No. Defaults to No.
S (DCE) Clock Rate (bps)	Defaults to the line speed of the WAN to which the DA-3x is connected when the clock source is external. When the clock source is internal, select from a table of standard clock rates (Figure 3-3). This field is related to the X (DTE) Clock Rate field. Thus, your selection here determines the rate of the X Clock and vice versa.
X (DTE) Clock Rate (bps)	Defaults to the line speed of the WAN to which the DA-3x is connected when the clock source is external. When the clock source is internal, select from a table of standard clock rates (Figure 3-3). This field is related to the S (DCE) Clock Rate field. Thus, your selection here determines the rate of the S Clock and vice versa.
Use External Oscillator	Toggle between Yes and No. Defaults to No.

Table 3-1 X.21 Line Interface Setup Fields

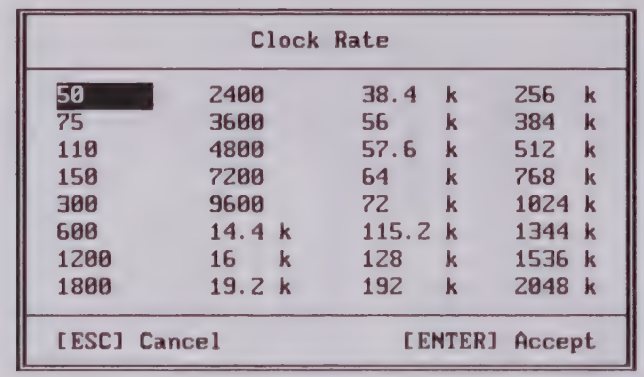


Figure 3-3 Clock Rate Selection Window

Kilobits per second is the unit used for those rates marked with a "k." For the others, the associated unit is bits per second.

3.2.1.2. V.24 & V.35 Line Setup

Figure 3-4 shows the V.24 and V.35 Line Setup Window and its default field settings.

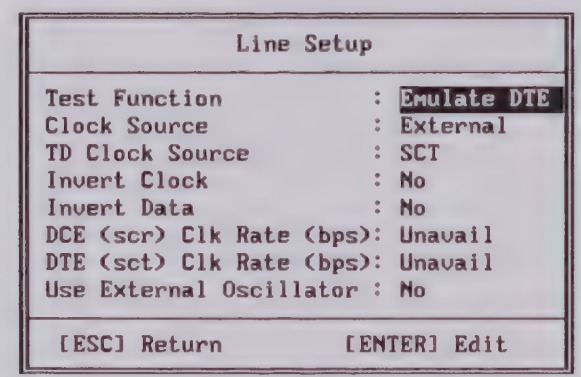

Line Setup
Test Function : Emulate DTE
Clock Source : External
TD Clock Source : SCT
Invert Clock : No
Invert Data : No
DCE (scr) Clk Rate (bps): Unavail
DTE (sct) Clk Rate (bps): Unavail
Use External Oscillator : No
[ESC] Return
[ENTER] Edit

Figure 3-4 V.24 and V.35 Line Setup Window

The V.24 and V.35 line setup options are listed in Table 3-2.

V.24/V.35 Line Setup Field	To modify...
Test Function	Toggle between Emulate DTE and Emulate DCE. Whenever this field is changed, the line speed is automatically re-determined before running BERT. Defaults to Emulate DTE.
Clock Source	Toggle between Internal and External. Whenever this field is changed, the line speed is automatically re-determined before running BERT. Defaults to External.
TD Clock Source	Toggle between SCT and SCTE. Defaults to SCT.
Invert Clock	Toggle between Yes and No. Defaults to No.
Invert Data	Toggle between Yes and No. Defaults to No.
DCE (scr) Clk Rate (bps)	Defaults to the line speed of the WAN to which the DA-3x is connected when the clock source is external. When the clock source is internal, select from a table of standard clock rates (Figure 3-3). This field is related to the DTE (sct) Clock Rate field. Thus, your selection here determines the rate of the DTE Clock and vice versa.
DTE (sct) Clk Rate (bps)	Defaults to the line speed of the WAN to which the DA-3x is connected when the clock source is external. When the clock source is internal, select from a table of standard clock rates (Figure 3-3). This field is related to the DCE (scr) Clock Rate field. Thus, your selection here determines the rate of the DCE Clock and vice versa.
Use External Oscillator	Toggle between Yes and No. Defaults to No.

Table 3-2 V.24 & V.35 Line Interface Setup Fields

Caution:

Operating the V.24 line interface at clock rates greater than 19.2 k is not recommended. Although higher clock rates are possible, the BERT_V24 application may give you unpredictable and unreliable results.

3.2.1.3. V.36 Line Setup

Figure 3-5 shows the V.36 Line Setup Window and its default field settings.

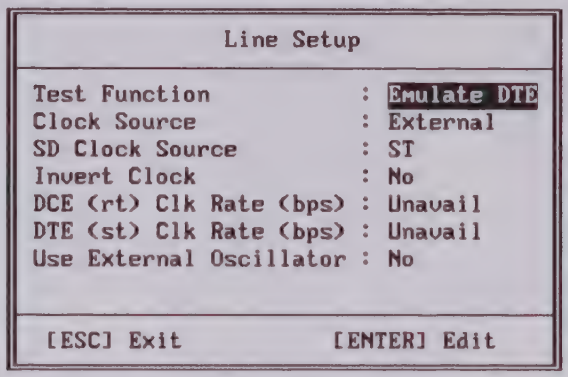

Line Setup
Test Function : Emulate DTE
Clock Source : External
SD Clock Source : ST
Invert Clock : No
DCE (rt) Clk Rate (bps) : Unavail
DTE (st) Clk Rate (bps) : Unavail
Use External Oscillator : No
[ESC] Exit
[ENTER] Edit

Figure 3-5 V.36 Line Setup Window

The V.36 line setup options are listed in Table 3-3.

V.36 Line Setup Field	To modify...
Test Function	Toggle between Emulate DTE and Emulate DCE. Whenever this field is changed, the line speed is automatically re-determined before running BERT. Defaults to Emulate DTE.
Clock Source	Toggle between Internal and External. Whenever this field is changed, the line speed is automatically re-determined before running BERT. Defaults to External.
SD Clock Source	Choose either ST, TT and RT. Defaults to ST.
Invert Clock	Toggle between Yes and No. Defaults to No.
Invert Data	Toggle between Yes and No. Defaults to No.
DCE (scr) Clk Rate (bps)	Defaults to the line speed of the WAN to which the DA-3x is connected when the clock source is external. When the clock source is internal, select from a table of standard clock rates (Figure 3-3). This field is related to the DTE (sct) Clk Rate field. Thus, your selection here determines the rate of the DTE Clock and vice versa.
DTE (sct) Clk Rate (bps)	Defaults to the line speed of the WAN to which the DA-3x is connected when the clock source is external. When the clock source is internal, select from a table of standard clock rates (Figure 3-3). This field is related to the DCE (scr) Clk Rate field. Thus, your selection here determines the rate of the DCE Clock and vice versa.
Use External Oscillator	Toggle between Yes and No. Defaults to No.

Table 3-3 V.36 Line Interface Setup Fields

3.2.1.4. T1 Line Setup

Figure 3-6 shows the T1 Line Setup Window and its default field settings.

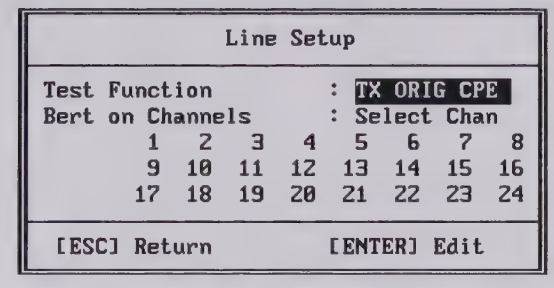

Line Setup
Test Function : TX ORIG CPE
Bert on Channels : Select Chan
1 2 3 4 5 6 7 8
9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24
[ESC] Return [ENTER] Edit

Figure 3-6 T1 Line Setup Window

The T1 line setup options are listed in Table 3-4.

T1 Line Setup Field	To modify...
Test Function	This is an auto-selecting field. Upon running the BERT Application, this field defaults to the Test Function setting on the Line Setup menu (accessed via the DA-3x Main Menu's interface slot window). The following message is displayed as a reminder at the bottom of the screen if you try to make a Test Function selection: "TEST FUNCTION may only be changed from LINE INTERFACE SETUP menu." The valid settings are: TX ORIG CPE, TX D&I CPE, and RECEIVE ONLY. The BERT Application does not support the TX ORIG NET and TX D&I NET settings.
Bert on Channels	Select from a list of 24 channels. Figure 3-7 shows the available channels. Defaults to all channels being selected.

Table 3-4 T1 Line Interface Setup Fields

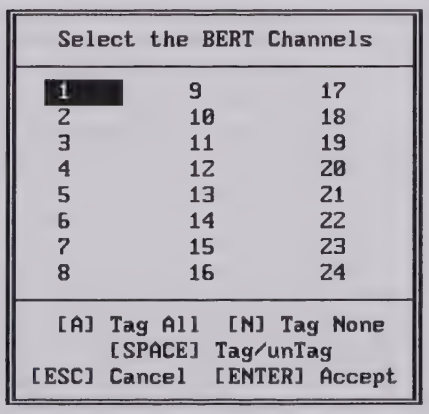


Figure 3-7 BERT Channels Selection Box

Pressing the Spacebar on a highlighted channel selection tags/untags it. Once a channel has been tagged, an asterisk is displayed next to the channel number on the Select the BERT Channels list and the channel number is simultaneously displayed in the appropriate channel position on the Line Setup window. To tag all the channels at once, press A. To untag all the channels at once, press N.

3.2.1.5. 2MBPS - ETSI Line Setup

Figure 3-8 shows the 2MBPS - ETSI Line Setup Window and its default field settings.

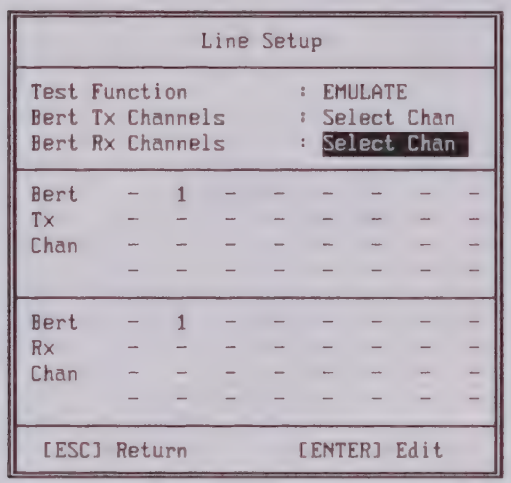

Line Setup
Test Function : EMULATE
Bert Tx Channels : Select Chan
Bert Rx Channels : Select Chan
Bert Tx Chan - 1 - - - - - -
- - - - - - - -
- - - - - - - -
- - - - - - - -
Bert Rx Chan - 1 - - - - - -
- - - - - - - -
- - - - - - - -
- - - - - - - -
[ESC] Return [ENTER] Edit

Figure 3-8 2MBPS - ETSI Line Setup Window

The 2MBPS - ETSI line setup options are listed in Table 3-5.

2MBPS - ETSI Line Setup Field	To modify...
Test Function	This field is not selectable. Upon running the BERT Application, this field is automatically set to EMULATE.
Bert Tx Chan	Select the transmit channels from a list of 32 channels. Figure 3-9 shows the available transmit channels. This field defaults to all channels being selected.
Bert Rx Chan	Select the receive channels from a list of 32 channels. Figure 3-9 shows the available receive channels. This field defaults to all channels being selected.

Table 3-5 2MBPS - ETSI Line Interface Setup Fields

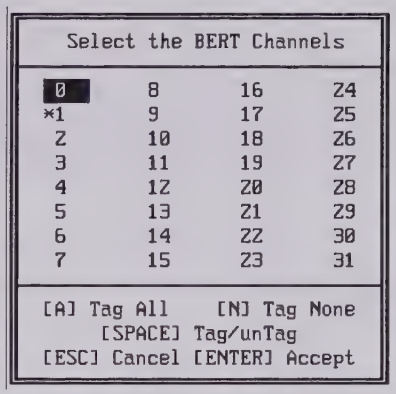

Select the BERT Channels
0 8 16 24
*1 9 17 25
2 10 18 26
3 11 19 27
4 12 20 28
5 13 21 29
6 14 22 30
7 15 23 31
[A] Tag All [N] Tag None
[SPACE] Tag/unTag
[ESC] Cancel [ENTER] Accept

Figure 3-9 BERT Channels Selection Box

Pressing the Spacebar on a highlighted channel selection tags/untags it. Once a channel has been tagged, an asterisk is displayed next to the channel number on the Select the BERT Channels list and the channel number is simultaneously displayed in the appropriate channel position on the Line Setup window. To tag all the channels at once, press A. To untag all the channels at once, press N.

3.2.2. Transmitter Setup

Figure 3-10 shows the Transmitter Setup window. This window allows the user to set the start time and test duration using the Time Setting option and select a test pattern using the Patterns option.

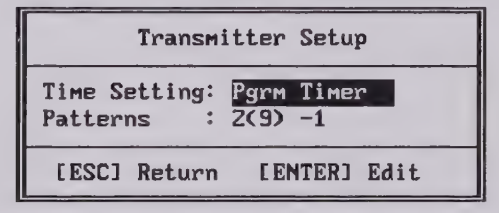


Figure 3-10 Transmitter Setup Window

3.2.2.1. Time Setting

This field allows you to program the BERT timer. The BERT timer has three modes of operation: continuous, programmed stop and programmed start/stop. Select the Time Setting field, and press Enter. The Time Setting window appears, as shown in Figure 3-11, presenting you with the three choices.

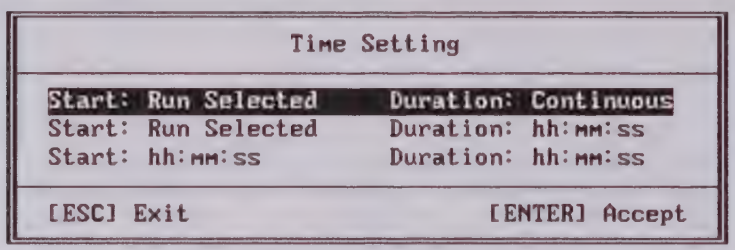


Figure 3-11 Time Setting Window

Note:

All time entries are based on the 24-hour clock. The BERT timer does not provide for setting the date. Consequently, time settings always refer to the current date.

Follow the steps listed for one of the following three modes to set the start time and/or duration.

Continuous Mode:

You want the BERT to start as soon as the DA-3x enters the BERT Run mode and to run continuously.

1. Position the cursor on the **Start: Run Selected Duration: Continuous** selection.
2. Press Enter to return to the Transmitter Setup window. The Time Setting field displays "Continuous."

Programmed Stop Mode:

You want the BERT to start as soon as the DA-3x enters the BERT Run mode and to stop running after a certain period of time. The BERT Application beeps twice at the completion of the BERT.

1. Position the cursor on the **Start: Run Selected Duration: hh:mm:ss** selection.
2. Press Enter to display a Clock Time Setting dialog box that prompts you for the test duration (Figure 3-12).

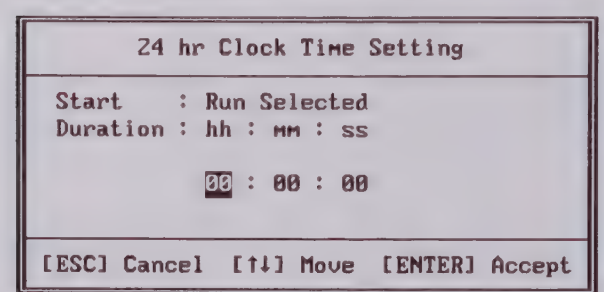


Figure 3-12 Dialog Box for the "Start: Run Selected Duration: hh:mm:ss" Option

3. The test duration is entered in the hh:mm:ss format. Using the Up/Down Arrow keys, position the cursor on the desired Duration time field: hh (hours), mm (minutes) or ss (seconds). The Down Arrow key moves the cursor one field to the right while the Up Arrow key moves the cursor one field to the left.

4. Enter a value for the selected field. After entering the desired test duration, press Enter to return to the Transmitter Setup window. The Time Setting field displays "Stop Timer."

   If you decide that you do not want to change the time setting, press Esc. You return to the Transmitter Setup window without making any changes.

Programmed Start/Stop Mode:

You want the BERT to start at a certain time after the DA-3x enters the BERT Run mode and to stop running after a certain period of time. The BERT Application beeps twice at the completion of the BERT.

1. Position the cursor on the **Start: hh:mm:ss Stop: hh:mm:ss** selection.
2. Press Enter to display a Clock Time Setting dialog box that prompts you for the start time and test duration (Figure 3-13).

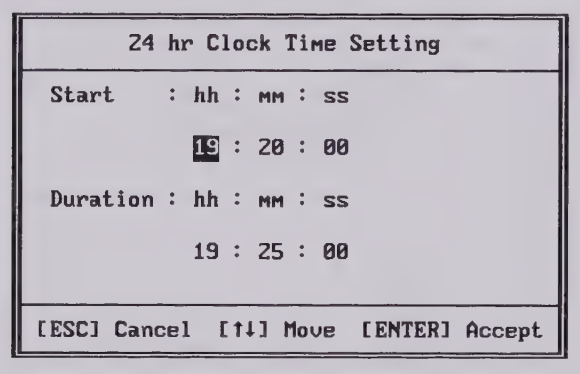


Figure 3-13 Dialog Box for the "Start: hh:mm:ss Stop: hh:mm:ss" Option

3. The start time is entered in the hh:mm:ss format. Using the Up/Down Arrow keys, position the cursor on the desired Start time field: hh (hours), mm (minutes) or ss (seconds). The Down Arrow key moves the cursor one field to the right while the Up Arrow key moves the cursor one field to the left.

4. Enter a value for the selected field. After entering the desired start time, either press Enter to return to the Transmitter Setup window or go on to set the test duration (Step 5). Pressing the Down Arrow key, while the ss field is selected, moves the cursor to the first Duration time field (hh).

5. The test duration is entered in the hh:mm:ss format. Using the Up/Down Arrow keys, position the cursor on the desired Duration time field: hh (hours), mm (minutes) or ss (seconds). The Down Arrow key moves the cursor one field to the right while the Up Arrow key moves the cursor one field to the left. Pressing the Up Arrow key, while the hh field is selected, moves the cursor to the last Start time field (ss).

6. Enter a value for the selected field. After entering the desired test duration, press Enter to return to the Transmitter Setup window. The Time Setting field displays "Pgrm Timer" to indicate that the BERT is under programmed control.

Note:

When editing a time field that has been cleared (contains 00), the first digit you type replaces the digit in the left position. Any subsequent digit you type replaces the digit in the right position.

When editing a time field that already contains a value, the digit you type replaces the digit in right position only. In order to modify the digit in the left position, you must, first, clear both digit positions by using the Backspace key and then type the desired two-digit number. Again, the first digit you type replaces the digit in the left position. Any subsequent digit you type replaces the digit in the right position.

If you decide that you do not want to change the time setting, press Esc. You return to the Transmitter Setup window without making any changes.

Upon entering the BERT Run mode, the application displays an alert message (Figure 3-14) indicating that the BERT timer has been programmed to start at a specified time.

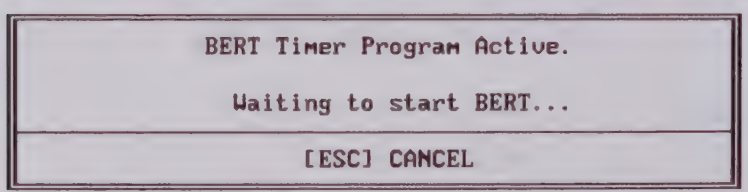


Figure 3-14 Programmed Start Alert Message

3.2.2.2. Patterns

This field displays the specific test pattern being used.

To select a BERT test pattern, follow these steps:

1. Select the Patterns field, and press Enter. The pattern selection window shown in Figure 3-15 appears.

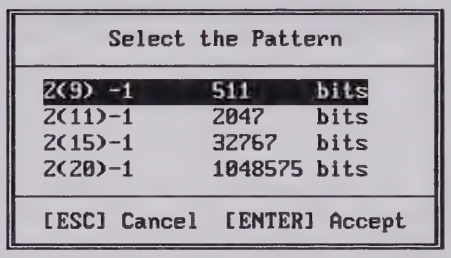


Figure 3-15 Pattern Selection Window

The pattern selection window lists the supported patterns and their corresponding bit lengths. Each pattern is given in the form of a polynomial as follows:

2(n) - 1 where n is the exponent of 2.

2. Using the Up/Down Arrow keys, position the cursor on the desired pattern. Press Enter to select it and return to the Transmitter Setup window. The Patterns field displays the pattern's polynomial.

   If you decide that you do not want to change the test pattern, press Esc. You return to the Transmitter Setup window without making any changes.

3.2.3. Print Run Screen

Figure 3-16 shows the Print Screen Period selection window. This window allows you to set the enable/disable automatic printing of the BERT Statistics screen. It also allows you to select the print period (time interval between screen prints).

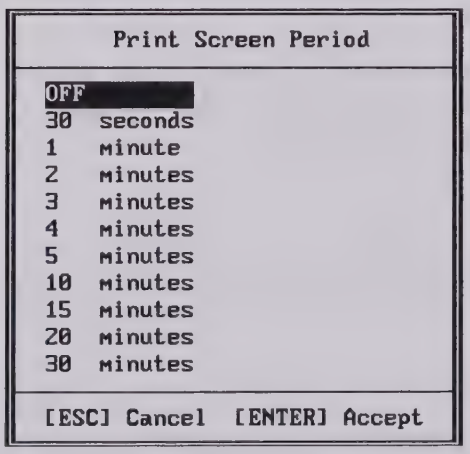


Figure 3-16 Print Screen Period Selection Window

To enable automatic printing, follow these steps:

1. Using the Up/Down Arrow keys, position the cursor on the desired print interval.
2. Press Enter to select the print period and return to the Setup pull-down menu.

To disable automatic printing, follow these steps:

1. Using the Up Arrow key, position the cursor on the OFF selection.
2. Press Enter to disable automatic printing and return to the Setup pull-down menu.

If you decide that you do not want to change the print period or the enable/disable status of automatic printing, press Esc. You return to the Setup pull-down menu without making any changes.

3.2.4. Adjust Loop Delay (for X.21 only)

Loop delay adjustment is meaningful only in cases where one of the loopback test configurations is being used and Verify Loopback is enabled. The Verify Loopback toggle is discussed in Section 3.2.5, "Verify Loopback."

When performing a loopback BERT, the DA-3x sends loopback initialization commands to the DCE (local or remote). In order to verify that the DCE is in the loopback mode before running BERT, the DA-3x searches for a loopback confirmation. This confirmation is the reception of the initialization test frame that was transmitted to the DCE.

The amount of time that the DA-3x waits for the return of the initialization test frame is known as the loop delay. A time-out occurs when the DA-3x does not receive the test initialization frame within the loop delay period. If this happens, the loop delay can be adjusted until an appropriate delay is achieved. The BERT Application allows for both manual and automatic loop delay adjustment. This section describes manual adjustment. Automatic loop delay adjustment is described later in Chapter 4 (Section 4.2, "Local LoopBack").

Figure 3-17 shows the Manual Loop Delay Adjustment window.

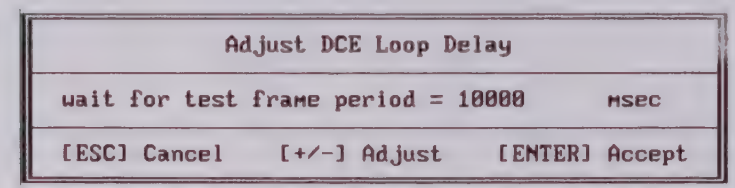


Figure 3-17 Manual Loop Delay Adjustment Window

The value that follows the "wait for test frame period =" string represents the current loop delay time-out value.

The default time-out value is 10,000 milliseconds. However, different modems (DCEs) will have different loop delays associated with them due to different line speeds, inherent device delays, etc. If you know what delay to expect, then you can manually adjust the loop delay in this window.

To manually adjust the loop delay time-out value, follow these steps:

1. Using the +/- keys, increment/decrement the loop delay time-out value in 50 millisecond steps. The maximum value for the loop delay time-out is 30,000 milliseconds. The minimum value is 500 milliseconds.
2. Press Enter to set the new loop delay value and return to the Setup pull-down menu.

   If you decide that you do not want to change the loop delay value, press Esc. You return to the Setup pull-down menu without making any changes.

3.2.5. Verify Loopback (for X.21 only)

The Verify Loopback is a toggle selection. It is used to verify that the DCE (local or remote) is in the loopback mode before running the BERT. When Verify Loopback is enabled, the DA-3x sends the initialization test frame to the DCE and then waits for a loopback confirmation from the DCE (local or remote) before running the BERT. When Verify Loopback is disabled, the DA-3x sends the initialization test frame to the DCE and starts running BERT without waiting for loopback confirmation from the DCE.

To enable/disable loopback verification, follow these steps:

1. Using the Up/Down Arrow keys, position the highlight bar on the Verify Loopback selection.

   Figure 3-18 shows the Verify Loopback selection when loopback verification has been enabled.

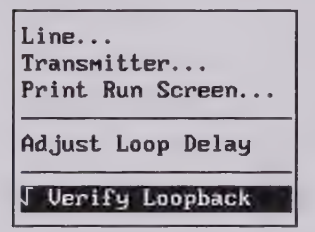
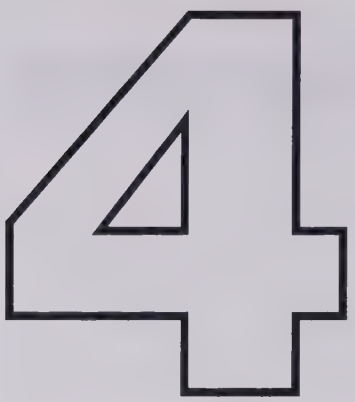


   Figure 3-18 Verify Loopback: Enabled

   When enabled, a √ symbol appears to the left of the selection. When disabled, nothing appears to the left of the selection.

2. Press Enter to enable/disable loopback verification. If loopback verification is not already enabled, pressing Enter enables it. Otherwise, pressing Enter disables it.



Performing the BERT

This chapter provides information on performing BERT. It also provides information on performing loopback initialization for a local and a remote DCE.

4.1. Overview of the Test

Before running the BERT, make sure you have made all necessary changes to the line setup and the transmitter setup. For more information on BERT test setup, refer to Chapter 4, "BERT Test Setup."

The BERT Application Run pull-down menu provides three options:

- Local LoopBack (for X.21 & V.24 only)
- Remote LoopBack (for X.21 & V.24 only)
- BERT

The Run pull-down menu is shown in Figure 4-1.

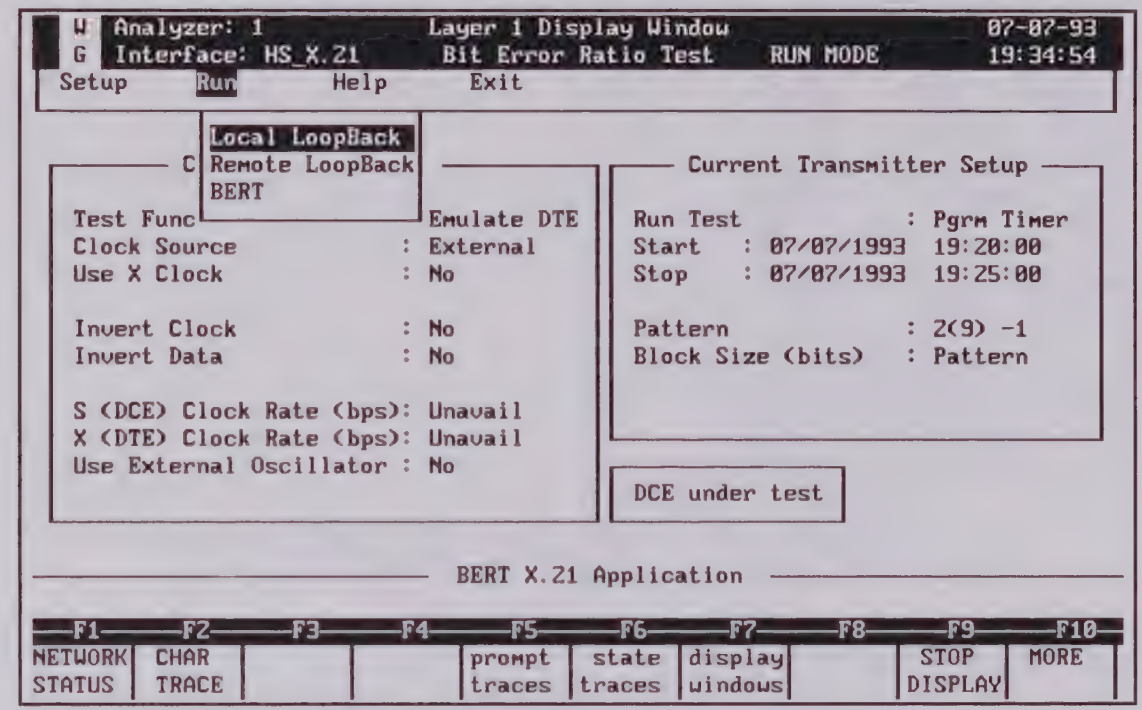


Figure 4-1 Run Pull-down Menu

The following sections provide information on these options along with the on-screen results of the tests.

4.2. Local LoopBack (for X.21 & V.24 only)

This selection causes the DA-3x to initialize the local DCE for loopback before running the BERT. Be sure your test setup is in a local loopback configuration and the DA-3x is setup for DTE emulation before making this selection.

To perform local loopback initialization, follow these steps:

1. Using the Up/Down Arrow keys, position the highlight bar on the Local LoopBack selection.
2. Press Enter to start local loopback initialization.

   If you decide that you do not want to perform local loopback, press Esc. You return to the BERT Main menu.

   If the DA-3x is not setup for DTE emulation, a warning message (Figure 4-2) is displayed.

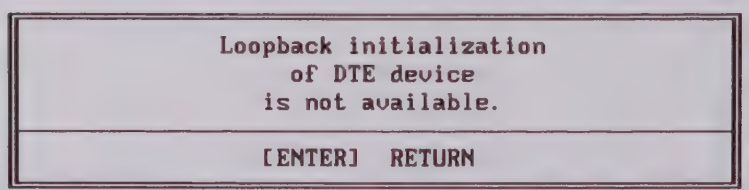


Figure 4-2 Warning Message: Loopback Not Available at DTE

If loopback verification is enabled (Verify Loopback selected) and the DA-3x does not receive loopback confirmation, the message shown in Figure 4-3 is displayed.

```
Test frame not seen.  Loopback not achieved.

[A] Auto Detect Delay          [ENTER] RETURN
```

Figure 4-3 Message: Loopback Not Achieved

You can respond by pressing one of the two keys listed in Table 4-1.

Key	Action
A	the BERT Application attempts to automatically detect the loop delay from the DCE. The application searches for a suitable loop delay by alternately incrementing and decrementing (in 50 millisecond steps) the default delay of 10,000 milliseconds. An Automatic Loop Delay Adjustment window is displayed as shown in Figure 4-4. It is similar to the window described in Section 3.2.4, "Adjust Loop Delay."
Enter	returns you to the BERT Main menu.

Table 4-1 Responses: Loopback Not Achieved

```
wait for test frame period = 9950       msec

iteration =                  2
```

Figure 4-4 Automatic Loop Delay Adjustment Window

The fields of the Automatic Loop Delay Adjustment window are listed in Table 4-2.

Field	Indicates...
wait for test frame period =	the current loop delay value
iteration =	the current iteration of the automatic loop delay adjustment routine

Table 4-2 Fields of the Automatic Loop Delay Adjustment Window

If a suitable delay is found, a message—telling you that the loop delay (time-out) has been calculated—is displayed on the Automatic Loop Delay Adjustment window. See Figure 4-5. Press Enter to accept the loop delay value.

Sometimes, the loop delay search will return a value which, when used, does not fit the loopback verification specifications. In this case, simply disable loopback verification (Section 3.2.5, "Verify Loopback").

```
wait for test frame period = 9950       msec

iteration =                  2

Modem Timeouts Calculated ...   [ENTER] Return
```

Figure 4-5 Automatic Loop Delay Adjustment Window: Suitable Delay Found

If the BERT Application cannot find a loop delay value that is less than or equal to 30,000 milliseconds (30 seconds) and greater than 500 milliseconds (0.5 seconds), it stops searching for loop delays and returns to the BERT Main menu.

Note:

Because various modems can have widely varying loop delay requirements, the automatic loop delay adjustment routine is not guaranteed to find a loop delay value that matches that of the modem you are testing. Therefore, if the loop delay search goes on for longer than you think is appropriate, simply press Esc to abort.

4.3. Remote LoopBack (for X.21 & V.24 only)

This selection functions in much the same way as the Local LoopBack selection. The only difference is that a remote—rather than local—loopback initialization is performed. This selection causes the DA-3x to initialize the remote DCE for loopback before running the BERT. Be sure your test setup is in a remote loopback configuration before making this selection.

To perform remote loopback initialization, follow these steps:

1. Using the Up/Down Arrow keys, position the highlight bar on the Remote LoopBack selection.
2. Press Enter to start remote loopback initialization.

   If you decide that you do not want to perform remote loopback, press Esc. You return to the BERT Main menu.

The DA-3x must be setup for DTE emulation in order to perform loopback. If not, a warning message (Figure 4-6) is displayed.

Figure 4-6 Warning Message: Loopback Not Available at DTE

If loopback verification is enabled (Verify Loopback selected) and the DA-3x does not receive loopback confirmation, the same messages and windows described in Section 4-2, "Local LoopBack" are displayed.

Note:

Version 1.0 of the BERT Application does not support software initialized loopback for the V.35 and V.36 interfaces—only X.21 and V.24.

4.4. BERT

The BERT computes standard BERT statistics as defined in the CCITT G.821 Recommendation.

Before running BERT, be sure the device under test is also in the BERT mode. You should also be sure the Test Function field on the BERT Line Setup menu is set to one of the emulation settings. If it is not, the application will not allow you to perform a BERT, and a message box appears displaying the following warning:

"BERT cannot run unless configured for EMULATE"

If emulating a DTE, be sure the interface clocks are present. If they are not, the warning message shown in Figure 4-7(a) is displayed. If emulating a DCE, be sure that you have selected clock rates from the Clock Rate selection boxes. If you have not and leave the clock rate fields set to "Unavail," the warning message shown in Figure 4-7(b) is displayed.

```
DCE clock is not available.

[ENTER]  RETURN
```

Figure 4-7(a) No Clock Warning Message (when emulating a DTE)

```
No Clock Rate detected.  Cannot enter BERT.

[ENTER]  RETURN
```

Figure 4-7(b) No Clock Warning Message (when emulating a DCE)

A BERT Statistics screen is shown in Figure 4-8.

```
W Analyzer: 1          Layer 1 Display Windou              07-07-93
G Interface: HS_X.21    Bit Error Ratio Test    RUN MODE    19:45:18
                                                          Sync = ON
BERT (G.821) Stats        Total          Ratio        Status
Test Seconds              3.5  E+01                   Elapsed Time: 00:00:36
Blocks Received           0.0                         Pattern     : 2(9) -1
Bits Received             1.4  E+01                   Block Size  : Pattern

Bit Errors                0.0            0.0          Line Rate : 9600    bps
Blocks in Error           0.0            0.0          Prn Intrvl: OFF

Available Seconds         3.5  E+01      1.0  E+02
Available Minutes         5.833E-01      1.0  E+02

Degraded Minutes          0.0            0.0          Passed ( < 10 %  )
Severely Errored Seconds  0.0            0.0          Passed ( < 0.2 % )
Errored Seconds           0.0            0.0          Passed ( < 8 %   )

[ESC] Stop     [R] Reset Statistics     [I] Insert Bit Error     [P] Print Screen
                          BERT X.21 Application
 F1        F2        F3        F4        F5        F6        F7        F8        F9        F10
NETWORK   CHAR                          prompt    state     display             STOP      MORE
STATUS    TRACE                         traces    traces    windous             DISPLAY
```

Figure 4-8 BERT Statistics Screen

In the upper right corner of the screen, a synchronization status field reports synchronization status as shown in Table 4-3.

Synchronization Status	Meaning
Sync = ON	Synchronization between the DA-3x and the device under test (DTE or DCE) has been achieved.
Sync = LOS	Synchronization between the DA-3x and the device under test (DTE or DCE) has been lost because the received signal has been either too low (or not present) for 175 or more consecutive time periods. All BERT statistics counts (discussed later) are frozen at their values prior to the instant that synchronization was lost. The counts are resumed as soon as synchronization is restored. This status message is displayed by the BERT_2M application only.
Sync = LOF	Synchronization between the DA-3x and the device under test (DTE or DCE) has been lost because the receiver has been out of frame (caused by two out of four consecutive framing bits being in error during a 3 millisecond period). All BERT statistics counts (discussed later) are frozen at their values prior to the instant that synchronization was lost. The counts are resumed as soon as synchronization is restored. This status message is displayed by the BERT_2M application only.
Sync = OFF	Synchronization between the DA-3x and the device under test (DTE or DCE) has either been interrupted or has not yet been achieved. All BERT statistics counts (discussed later) are frozen at their values prior to the instant that synchronization was lost. The counts are resumed as soon as synchronization is restored.

Table 4-3 Synchronization Status

The synchronization status determination is based on a percentage of bit errors detected during any given one-second interval. When this percentage exceeds a certain threshold, the BERT Application determines that synchronization on the transmission line has been interrupted. The synchronization threshold varies depending on the BERT test pattern being used. Table 4-4 lists the various threshold values.

Pattern Selection	Synchronization Threshold
2(9) - 1	20 %
2(11) - 1	15 %
2(15) - 1	15 %
2(20) - 1	1 %

Table 4-4 Synchronization Threshold Values

In the case of BERT_T1, a loss of framing does not necessarily cause a loss of synchronization. If the Framing field on the T1 Current Line Setup window is set to ESF (or ESFz) and a data stream that uses another framing method (e.g. UNFRAMED) is received, BERT_T1 will not lose synchronization. Although this results in a large number of bit and block errors, the rate of these errors is not high enough to cause BERT_T1 to lose synchronization.

Note:

When using any of the patterns larger than 2(11) - 1, be sure that you are running at one of the higher clock rates (i.e. greater than 256 k). Otherwise, line synchronization may never be achieved.

The rest of the screen is divided into four columns: BERT (G.821) Stats, Total, Ratio, and Status. The BERT (G.821) column reports the field name for each of the standard BERT statistics.

Table 4-5 provides information on the fields displayed on the BERT Statistics screen. Each of the statistics are updated every second.

Field	Indicates...
Test Seconds	The number of seconds that have elapsed since achieving synchronization (Sync = ON) between the DTE and DCE. If synchronization is lost (Sync = OFF), this count is stopped. The count resumes when synchronization is restored.
Blocks Received	The number of blocks received from the line.
Bits Received	The number of bits received from the line.
Bit Errors	The number of bit errors detected (Total column). The ratio (BER) of Bit Errors to Bits Received (Ratio column).
Blocks in Error	The number blocks in which 1 or more bit errors have been detected (Total column). The ratio of Blocks in Error to Blocks Received (Ratio column)
Available Seconds	The difference between Test Seconds and Unavailable seconds (Total column). Unavailable Seconds are internally monitored and are not displayed. An unavailable second is defined as a one-second interval in which the BER is greater than or equal to 1×10^{-3}. However, the occurrence of ten consecutive seconds in which the BER does not equal or exceed 1×10^{-3} is considered available time. When this happens, the Unavailable Seconds count is decremented by 10, and the Severely Errored Seconds count is incremented by 10. The ratio of Available Seconds to Test Seconds multiplied by 100 (Ratio column).
Available Minutes	The Available Seconds represented as minutes (Total column). The ratio of Available Minutes to Test Seconds multiplied by 6000 (Ratio column).
Degraded Minutes	The number of available 60-second intervals—excluding Severely Errored Seconds—in which the BER exceeded 1×10^{-6} (Total column). The ratio of Degraded Minutes to Available Minutes multiplied by 100 (Ratio column).
Severely Errored Seconds	The number of one-second intervals in which the BER is greater than or equal to 1×10^{-3} (Total column). However, the occurrence of 10 consecutive severely errored seconds is considered unavailable time. When this happens, this count is decremented by 10, and the Unavailable Seconds count is incremented by 10. The ratio of Severely Errored Seconds to Available Seconds multiplied by 100 (Ratio column).
Errored Seconds	The number of one-second intervals in which the BER was between 0 and 1×10^{-3} (Total column). The ratio of Errored Seconds to Available Seconds multiplied by 100 (Ratio column).

Table 4-5 BERT Statistics Screen Fields

The Total column reports the total counts associated with each of the statistics fields in the following scientific notation format (to four significant figures):

0.0000E+/-00

The Ratio column reports the ratios for the Bit Errors, Blocks in Error, Available Seconds, Available Minutes, Degraded Minutes, Severely Errored Seconds, and Errored Seconds fields. These ratios are reported as percentages in the scientific notation format (to four significant figures).

There are two text strings that may also appear in the Ratio column: "NaN" (Not a Number) and "Inf" (Infinity). "NaN" is displayed whenever the ratio evaluates to an indeterminate value (e.g. result of a division by zero). "Inf" is displayed whenever the ratio evaluates to a number too large to be represented in the scientific notation format.

The Status column reports:

- Elapsed Time: The amount of time that has elapsed since entering Run Mode.
- Pattern: The test pattern being used—expressed as a polynomial
- Block Size: The size (in bits) of a block. This field displays the text string "Pattern" because the block size defaults to the size of the test pattern. Table 4-6 shows the number of bits that correspond to the available patterns.

Pattern	Block Size (bits)
2(9) - 1	511
2(11) - 1	2047
2(15) - 1	32767
2(20) - 1	1048575

Table 4-6 Block Sizes for Test Patterns

- # Tx Chan: The number of transmit channels operating at the rate shown in the Line Rate field. This field is shown only when running the BERT_2M application.
- # Rx Chan: The number of receive channels operating at the rate shown in the Line Rate field. This field is shown only when running the BERT_2M application.
- # of Chan: The number of channels operating at the rate shown in the Line Rate field. This field is shown only when running the BERT_T1 application.
- Line Rate: The clock rate as set on the Clock Rate Selection window (Figure 3-3) or detected on the line. If running either the BERT_T1 or the BERT_2M application, the line rate is displayed in "kbps" (kilobits per second). For the other interfaces, the line rate is displayed in "bps" (bits per second).
- Prn Intrvl: The print period as set on the Print Screen Period selection window (Figure 3-14).

- The Pass/Fail status of the following fields: Degraded Minutes, Severely Errored Seconds, and Errored Seconds. Table 4-7 shows the possible status messages and their meaning.

Field	Status Message	Indicates...
Degraded Minutes	Passed (< threshold 10%)	the ratio is less than the G.821 10% threshold.
Severely Errored Seconds	Passed (< threshold 0.2%)	the ratio is less than the G.821 0.2% threshold.
Errored Seconds	Passed (< threshold 8%)	the ratio is less than the G.821 8% threshold.

Table 4-7 G.821 Threshold Values

At the bottom of this screen, a few important keys are listed. These keys have special functions while you are performing the BERT. See Table 4-8.

Key	Function
Esc	stops performing the BERT and returns you to the BERT Main menu
R	resets all the BERT statistics
I	inserts a single bit error into the data stream
P	outputs the BERT Statistics screen to a printer

Table 4-8 Relevant Keys for the BERT